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NEW SOUTH WALES.

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THE HON. JOHN PERRY, M.P.,

MINISTER OF AGRICULTURE.

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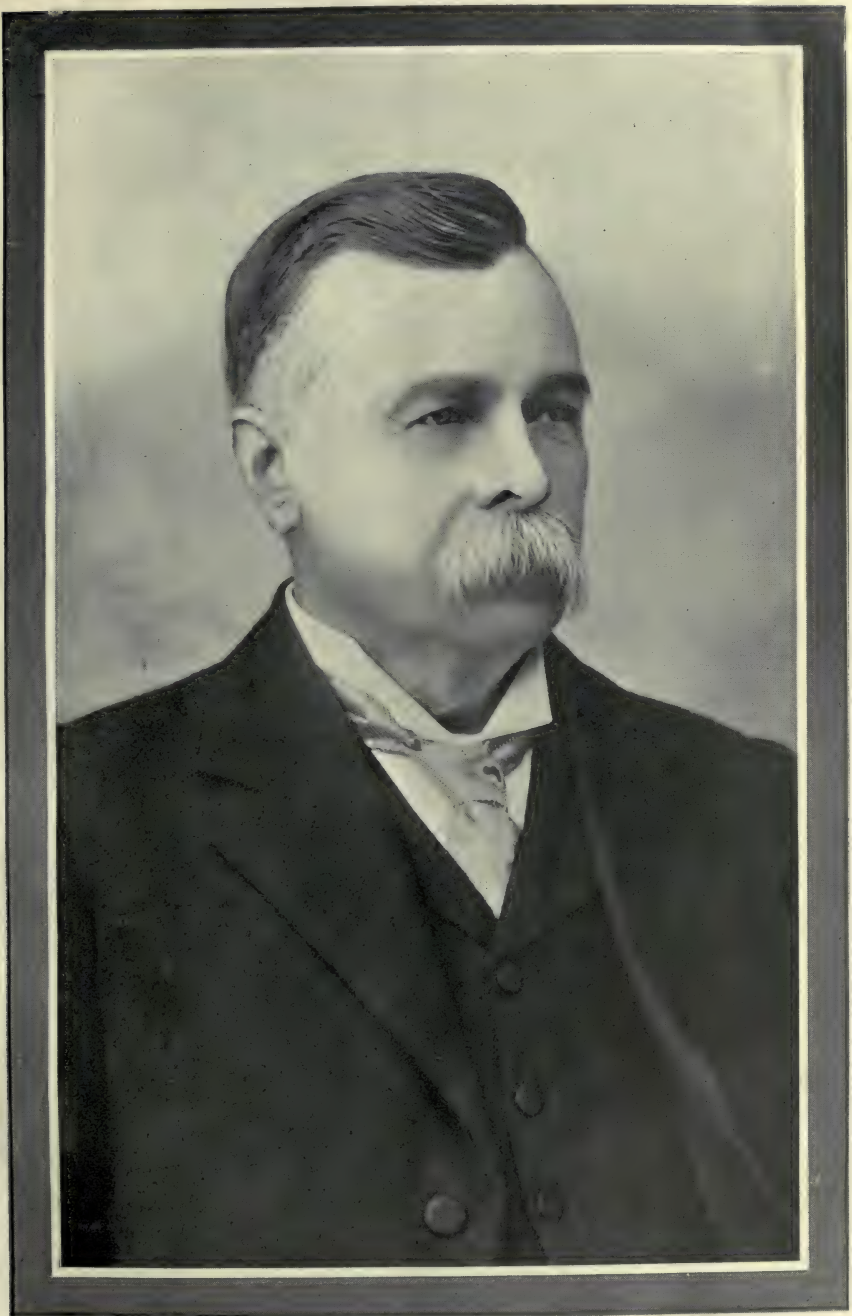


THE HONORABLE JOHN PERRY, M.P.,
THE FIRST MINISTER OF AGRICULTURE, NEW SOUTH WALES.

Vol. XX. Part 1. JANUARY 2, 1909.

Agricultural Gazette of New South Wales.

A Message from the Minister of Agriculture to the Agriculturists of New South Wales.

I desire to take into my confidence the rural workers of the State, by publishing in this, their *Gazette*, an outline of the policy I have set myself to accomplish, as head of the Department of Agriculture, for their benefit; and, in the work of improvement and reform, I trust to be encouraged by their approval and co-operation.

Farmers' Experiment Plots.

The work of the Department during the year just ended has been one mainly of reorganisation and initiation of reforms and innovations, which, I hope, will bear fruit in improved farming methods and, eventually, in increased yields. The principal departure from the Department's usual line of working was in the establishment of experiment plots. Recognising that the Government Experiment Farms—most useful institutions for the carrying out of experiments in crops, &c., suited for the districts in which they are situate—influenced only a small circle of farmers in their immediate neighbourhood, the co-operation of farmers throughout the State was invited, and with their assistance the Department has been able to establish experiment plots on the farmer's own land, worked by the farmer and his own labour, with his own implements, under the supervision of an Inspector of the Department who pays periodic visits, the Department supplying seed and manure. This system enables plots to be established in almost every district in the State; the work being done by the farmer enables him to ascertain the exact cost, and to gain practical experience in improved methods; while many more persons are interested and instructed than would be the case if the work were carried out on one of the Government farms. A more detailed account of what has been done in this direction appears in another part of this *Gazette*.

Housing the Department.

Realising the waste of energy caused by the present scattered condition of the branches of the Department, and that effective control and supervision are impossible until the head-office staff is brought under one roof, I consider that attention must be given in the near future to the provision of a suitable building to accommodate the officers of the Department, and thereby minimise the inconvenience to the public who now have to wander all over the city in search of our various branches.

The Staff.

The educational and scientific staff of the Department will be greatly strengthened. A superintendent of scientific and educational investigations will be appointed, whose duty it will be to correlate all the scientific and experimental investigations of the Department at the Hawkesbury Agricultural College, and the different farms. A chief inspector has already been appointed, and has inaugurated the system of experimental plots. An economic botanist will be attached to the Department for the purpose of supervising the introduction of new grasses, fodder plants, fibres, and other plants of economic value. Such an officer will be able to advise the public as to the foodstuffs, grasses, and other fodders best suited to their respective districts. A sheep and wool expert will be appointed to advise the Department on all technical matters relating to sheep-breeding and wool-classing, and to advise sheep-breeders generally. In view of the great storage works at Barren Jack, and the irrigation scheme on the Murrumbidgee, a most important officer will be the irrigation and drainage expert, who will advise the Government on all irrigation schemes and operations, and educate the public on irrigation and drainage matters. Inspectors and instructors will be appointed who will be experts in the various branches of rural work, and will go out amongst the farmers and instruct them in up-to-date methods. For instance, two experts in silo-building and the making of silage will be appointed—one for the Table lands and Western Slopes, and the other for the coastal regions. These officers will advise as to the construction of silos best suited to the local conditions, and the best herbage and crops to conserve for the purpose, and whenever practicable, superintend the making of silage. I do not, however, propose to usurp the functions of the Government Savings Bank in making financial advances to farmers to assist them in building silos. The Stock Branch will be strengthened by a veterinary surgeon and assistant instructors, who will be authorities on all diseases of stock, and capable of instructing stock inspectors and the students at the College and Government farms. The assistants will have charge of specific districts; they will be available for giving demonstrations and short courses of lectures to farmers and dairymen.

Experiment Farms and Plots.

I am receiving many applications for experiment farms to be established in certain districts. It is manifestly impossible to comply with many of these demands, and I hope to have a system of experiment plots which will satisfy reasonable requirements. The existing establishments will, however, be brought up to date, and in many instances the staffs will be strengthened by the appointment of experimentalists. A system of book-keeping has been initiated at the farms by the means of which will be proved in plain figures the fact that farming on scientific lines will pay. The cost of the experimental and educational work must, of course, be excluded from the farm accounts proper.

Dairying.

The subject of dairying is, however, so important to our national welfare that I have decided to establish an experiment farm in the centre of the dairying district on the South Coast to specially deal with that one subject. In close proximity, accommodation will be provided for a veterinary school in connection with the University for the training of stock inspectors and veterinary surgeons, at which students will be able to obtain their practical training.

Already much success has attended the policy of importing first-class dairy bulls and stationing them at the farms for service in the district as well as leasing them out to farmers at a low figure. It is intended to continue on these lines in the future.

Very useful work has been done at the Berry Stud Farm in the direction of rearing high-class dairy cattle for use at the experiment farms and for sale to dairy farmers, and a continuance of this policy cannot but lead to a great improvement in our dairy herds.

Cattle Tick.

A serious danger which threatened the dairying industry on the North Coast has been averted for the time being by the most unremitting vigilance and attention. I refer to the outbreak of cattle tick. Thirty-nine officers were engaged on duty on the Queensland border, and the strictest surveillance will be continued to save our dairy herds from this scourge.

Sheep.

Experiments have been conducted to obtain data respecting the most suitable crosses for the production of lambs and mutton for export, and will be continued for the information of our sheep-breeders with a view to improving our trade in this direction.

Horse-Breeding Industry.

With a view to encouraging this important industry, I have decided instead of introducing legislation to authorise me to impose a tax on stallions and order the destruction of unsound animals, to issue Government certificates of soundness and approval to all stallions standing for public service, which, on inspection and examination by one of the Government veterinary officers, shall be found free from hereditary unsoundness. When this scheme shall have been given effect to throughout the State, it is improbable that breeders will send mares to stallions not possessing the Government certificate, and by this means a vast improvement in the class of horses bred will be effected without resource to harassing legislation.

Bureau of Microbiology.

Although not under my Ministerial control, I must make reference to the establishment of the Bureau of Microbiology, as it will be in close touch with this Department and deal with many matters of interest to agriculturists.

Attention will be paid to methods for eradicating the rabbit pest, and problems of soil fertility and manufacture of butter, cheese, and wine, as well as questions connected with the presence or absence of micro-organisms in the soil and the various products thereof.

Farm Schools.

There is an urgent demand from farmers for the services of boys fitted to be useful assistants on a farm, and, on the other hand, a strong desire is being shown on the part of city boys to go out into the country and engage in this class of work. A year's training will be given to a number of boys who will give their labour in return for tuition; boys taking another year's work, as will be desirable, will probably be worth a wage in addition to their keep and tuition. By this means I hope to make available a number of efficient farm labourers.

Education in Agriculture.

The accommodation for students at the Hawkesbury Agricultural College and experiment farms has been enlarged, so that at present over 200 students can be taken at the College, 53 at Wagga, and 33 at Bathurst, and 12 at Wollongbar. At Berry Stud Farm, non-resident pupils are taken. There is, as yet, no accommodation for students at the Glen Innes Experiment Farm, but provision has been made on the Estimates for extending the work at this establishment. It is intended to draw a broad line of demarcation between the schools at the experiment farms and the Hawkesbury Agricultural College. The former will provide a primary agricultural education, and will cater for boys who have just left the primary schools. The boys will obtain at the farms a general practical knowledge of the farm operations peculiar to the district, and an insight into the scientific principles underlying each of the operations. The Hawkesbury Agricultural College, at which secondary education in agriculture will be given, will be made a connecting link between the primary schools and the University.

I have decided to reintroduce the system of giving bursaries to sons of poor parents who, upon examination, show special aptitude for agricultural work. Bursaries will be given from the primary schools to the farm schools, from the farm schools to the Hawkesbury Agricultural College, and in due course, when the School of Agriculture at the University is in operation, from the College to the University.

The Senate of the University has already formulated a scheme of advanced education in agriculture and veterinary science at that institution, and steps are being taken by means of amending legislation to provide additional funds for the purpose.

I must here take the opportunity of expressing my appreciation of the public-spirited action of the proprietors of the *Sydney Morning Herald* and *Sydney Mail*, and the *Daily Telegraph*, in presenting bursaries to students in agriculture. The example set by the newspaper proprietors is surely one which might very appropriately be followed by the many men of wealth who have gained fortunes from the soil.

Dissemination of Information.

The *Agricultural Gazette*—the official publication of the Department—reaches a very small proportion of our farmers, and contains a large amount of purely scientific matter which is of little interest to the average farmer. In order to come into touch with every practical farmer in the State, Farmers' Bulletins are being published, written simply for the education of the class of rural worker concerned. They are divided into series relating to wheat growing, sheep and wool, wine growing, fruit growing, dairying, &c., and will be distributed free of charge. On the other hand, the *Gazette* will be popularised and its sphere of influence extended.

Fruit Growing.

Owing to the ravages of insect and fungous pests, and to the impoverishment of the soil after many years of cultivation, it is generally admitted that the fruit industry of the county of Cumberland is in a perilous condition. The quantity of fruit produced is a matter of congratulation, but the quality leaves a great deal to be desired. It is my intention to carry out a series of experiments in the county of Cumberland, relating to the improvement of soil by fertilising, drainage, and green manuring. An insectarium has already been established at Narara, where observations are being made in regard to fruit-fly, and experiments will be carried out with methods for eradicating that and other pests. Additional attention is being paid to more stringently enforcing the provisions of the Fruit Pests Act, and already a large measure of improvement has been noticed in the condition of orchards generally. Experiments are being made in other directions, such as, for instance, in diminishing the black spot in oranges and other fruit diseases, with a view to the improvement of the fruit produced in this State.

Viticulture.

A viticultural station has been formed near Raymond Terrace, in soil immune to phylloxera, and in the centre of an important and uninfected district, for the propagation and distribution of phylloxera-resistant stocks and rootlings. Provision will be made for the propagation and distribution of a large number per annum to enable vinegrowers to replant their vineyards, and educational information will be made available for wine manufacturers and viticulturists.

Irrigation.

An experiment irrigation farm has been established at Yanco and planted with vines, fruit and nut trees, and sown for hay and fodder crops in order to demonstrate to intending settlers on the Murrumbidgee Irrigation Scheme what can be grown on this land by means of irrigation, and the methods that should be adopted to ensure success. In view of the large amount of Government funds invested in the undertaking, I consider the successful working of the farm, on practical lines, to be most important.

It is impossible in the space available in this *Gazette* to set forth *in extenso* my policy in regard to every branch of agriculture, but in addition to what I have outlined above, I may mention that attention is also being paid to the questions of irrigation by bore waters and the neutralising of the effects of their alkaline qualities; the preparation of a list of competent judges who shall be available for agricultural and pastoral societies; improved methods to be adopted in marketing produce and handling of grain; conveyance of milk and country-killed meat; cold storage and freight over sea.

With the voluntary assistance of the people themselves, I desire to effect as many reforms as possible without having recourse to compulsory legislation. Should that assistance be willingly forthcoming, there will be no possibility of friction between the Departmemt and the people.

The Department of Agriculture has, I hope, entered upon a new sphere of usefulness. To enable the products of New South Wales to successfully compete in the world's markets with advantage and profit to the producers, the farmers must wake up; they must invoke to their assistance the mighty hand of science; they must abandon methods, the only recommendation in favour of which is that their fathers and grandfathers used them. "The old order changeth and giveth place to the new," and the "new order" is based upon intelligence and science. It is the duty of my officers, the scientific and the practical, to render to the humblest farmer on the land assistance in the form of practical advice, and, whenever possible, personal instruction. I urge upon the rural workers of the State the vital importance of availing themselves of the opportunities at their hand. Are they taking up new country and are uncertain as to the best crops to raise from it? Then let them send samples of the soil to the Department, and it will be examined free of charge by the chemist and the bacteriologist, and practical men will give advice based on this examination as to the most suitable crops to raise, what elements it lacks, what class of manure to apply, and what other measures to adopt. If orchard country, the Fruit Expert will say what fruits are most suitable to the district; if wheat country, the Wheat Experimentalist will advise. If insect pests are troubling, let them send specimens to the Entomologist who will name them and prescribe a remedy; if fungous diseases are doing harm, a trained Pathologist will identify the cause and advise accordingly; if unknown weeds are prevalent, or if new grasses and improved fodder-plants are needed, the Botanist will advise; and if diseases are deciminating the stock, the Veterinary Surgeon will be ready with his knowledge and advice. The Department will advise in every branch of agricultural work, and that advice will be given freely and willingly. The collated experience of kindred departments in Europe and America is entirely at our disposal, and we can therefore benefit by the experiments and investigations carried on in Great Britain, the United States, Canada, France, Germany, Italy, and other Australian States, through our system of exchanges of publications and reports. We are thereby enabled to prescribe appropriate action for diseases and pests which are quite new to us, but have previously been recorded elsewhere. The

whole world is one great Commonwealth to men of science and the progressive minds controlling the primary industries. We can learn much from the successes and the failures of fellow-workers in other countries. Let us add our little quota to the sum total of Agricultural knowledge.

To the Agriculturists of New South Wales I desire to express my wish for a most "Prosperous and Happy New Year."

John Perry

Method of Payment for Cream supplied to Butter Factories.

The attention of the Department of Agriculture has been drawn by its dairy inspectors to the pernicious system of payment for cream adopted by some butter factories.

The practice is to reduce the test of suppliers' cream by 2 or 3 per cent., and then compute, from the chart issued by the Government Dairy Expert, the quantity of butter to be paid for on the lower basis. A good price is then paid on the smaller quantity, thus making it appear to the dairy farmers that their cream is first-class, whereas a second-class price is really obtained for the butter. For example, 2,000 lb. butter may be manufactured on a certain day, yet only 1,850 lb. would be paid for, that being the quantity produced according to the chart, *i.e.*, after deducting the 2 or 3 per cent. already referred to. A high price is, however, given for the latter quantity, so that, although the suppliers may not suffer much pecuniary loss, they are led to believe that their cream is of better quality than it really is. The consequence is—and this is the worst feature of the whole matter—that the dairy farmer, finding he is getting what are apparently top rates for his butter, makes little or no effort towards improvement.

In order that they may fully realise their position, dairy farmers are recommended to send samples of their cream to the Department of Agriculture to be tested, so that they may themselves know the test of their cream and the quantity of commercial butter a certain quantity of it should produce.

Farmers' Experiments.

G. VALDER,
Acting Chief Inspector, Department of Agriculture.

THE work in connection with this branch of the Department was commenced in April of last year. Operations were at first conducted on a somewhat limited scale, as delay occurred in getting in the returns of the offers of land by farmers for experiment plots, and the dry autumn experienced in most districts deterred late sowing on a large scale.

The matter was, however, enthusiastically taken up by farmers in all parts of the State, and upwards of 600 offers of land were made from which to select the plots required.

Autumn Sown Crops.

Although the autumn sowing was, as already stated, greatly restricted, a number of very interesting trial plots were sown of the following crops.

Wheat.—The trials were confined to—

a Trial of varieties. *b* Trial of manured *v.* unmanured plots.

The variety trial consisted in ascertaining whether selected varieties of cross-fertilised wheats were superior in yield to the best variety or varieties hitherto grown in the district in which the plots were being established.

In most cases the experiment areas were divided into long narrow strips of half an acre each, the usual size being about 10 chains long by half a chain wide. This width was obtained by using a drill 8 feet wide, making four cuts for each plot, and a space the width of the drill was left between the plots so as to allow of the harvester being worked on any of them without coming into contact with the crops in the plots on either side of it. The following is a plan of an 8-acre plot :—

WHEAT EXPERIMENT.

	1	2	3	4	5	6	7	8	9	10	11	12	13	
10 CHAINS.	Chaunt's Prolific.	Bobs.	Federation.	Comeback.	Jonathan.	Chaunt's Prolific. No manure.	Chaunt's Prolific. 34 lb. No. 1 superphosphate.	Chaunt's Prolific. No manure.	Chaunt's Prolific. 34 lb. A manure.	Chaunt's Prolific. No manure.	Chaunt's Prolific. 34 lb. No. 11 manure.	Chaunt's Prolific. No manure.	Chaunt's Prolific. 34 lb. No. 19 manure.	10 CHAINS.
	½ chain.	½ chain.	½ chain.	½ chain.	½ chain.	½ chain.	½ chain.	½ chain.	½ chain.	½ chain.	½ chain.	½ chain.	½ chain.	

It will be seen that there are thirteen plots of half an acre each = 6½ acres; to this add the 8-feet spacing between each plot, and this gives a total area of 8 acres.

The local variety selected in this instance was Chaunt's Prolific, a well-known and popular strain of the old Purple-straw type. This variety was, it it will be seen, sown on either side of the four cross-fertilised varieties selected by the Department.

The plots varied from as small as 2 acres at Tenterfield to 15 acres at Wellington, according to the land available. With a small plot, such as that at Tenterfield, only a variety test of four half-acre blocks could be put in, but with an 8 or 10 acre plot a fairly complete variety and manurial trial was sown.

The varieties under trial were as follows:—

Selected by the Department: Bobs, Bunyip, Comeback, Federation, Firbank, John Brown, Jonathan, Jumbuck, Plover, Powers' Fife, Rymer, Schneider, Tarragon, and Thew.

Local varieties: Allora Spring, Chaunt's Prolific, Marshall's No. 3, Purple-straw, Steinwedel, and White Hogan.

Oats.—The previous season having been a bad one for the oat crop, it was difficult to get good seed of any number of varieties, only four being available, viz., Algerian, Abundance, Potato, and White Tartarian. Variety and manurial trials of these were conducted in a similar manner to the wheats, and also trials of oats alone against oats and peas mixed were made, the following being the arrangement of a 6-acre plot, viz.:—

OAT EXPERIMENT.

	½ acre.	½ acre.	½ acre.	½ acre.	½ acre.	½ acre.	1 acre.	1 acre.	
10 CHAINS.	Algerian Oats. No manure.	Algerian Oats, ½ cwt. bone-dust.	Algerian Oats, ½ cwt. superphosphate.	Abundance Oats.	Potato Oats.	White Tartarian Oats.	1½ bushels White Tartarian Oats.	{ 1 bushel White Tartarian Oats. ½ bushel Grey Field peas.	10 CHAINS.
	½ chain.	½ chain.	½ chain.	½ chain.	½ chain.	½ chain.	1 chain.	1 chain	

The objects of the variety experiments are—

1. To find the best oat for green fodder and hay.
2. The best for grain.

The trial of oats and peas *v.* oats is to endeavour to show—

a. That the mixture will yield heavier crops of fodder than oats alone.

b. That the mixed fodder has a much higher feeding value.

c. That the mixed crop takes less out of the soil.

Barley.—Trials of malting barleys, and also of barley for green feed have been commenced. Only a few varieties were available, but next season it is hoped that some few more will be added to the list.

Plots of Sheeps' Burnet, Linseed, and Field Peas were also sown during the autumn.

Spring Sown Crops.

For spring-sown crops, operations were almost entirely confined to the coastal districts, and the principal crops experimented upon were grasses, forage plants, potatoes, and tobacco.

Grasses.—Special attention was given to the question of improving our pastures; and by way of a commencement, some twenty plots were top-dressed with fertilisers, these plots being selected from a number offered at the following places:—Wollongong, Albion Park, Dapto, Kiama, Berry, Nowra, Milton, Camden, Moss Vale, Kangaroo Valley, Robertson, &c.

As a rule, pastures which showed signs of "wearing out" were selected for treatment, but several of those treated showed a really good sole of grass.

Arrangements are also being made to treat certain lands for laying down to grasses in the autumn. The area being divided into four plots as follows:—

1. To have a crop of cowpeas grown on it during the summer, which will either be ploughed in or eaten off with sheep or other farm stock.
2. To be fallowed during the summer and treated with fertiliser in the autumn.
3. To be fallowed during the summer; to be treated first with lime in the autumn, and later on fertilised at time of sowing the grass-seed.
4. To be fallowed, but to receive no manure.

Arrangements are also being made to sow down plots in the autumn with various mixtures of both native and introduced grasses.

Forage Plants.—Of the forage plants sown, the principal were maize, sorghum, millets, and cowpeas. Varieties of these were sown in a similar manner to the wheat plots, together with varieties of manures, and combinations of maize and cowpeas, sorghum and cowpeas, &c.

The cultivation paddocks in the coastal districts being small in comparison with those in the wheat districts, it was found advisable to cut down the area of each variety from half an acre to a quarter of an acre. The areas available varied in size from 4 to 7 acres, and, where possible, the plots were made ¼ chain wide by 10 chains long, the long, narrow strips being considered even more necessary on the land in the coastal districts than inland,

as the soils vary often every few yards. The following is a specimen of the manner in which a 6-acre plot of forage plants was laid out :—

1 acre Maize Varieties.	Hickory King, 129 lb. per acre.	¼ acre.
	Red Hogan, 129 lb. per acre.	¼ acre.
	Yellow Dent, 129 lb. per acre.	¼ acre.
	Yellow Dent, 129 lb. per acre. Black Cowpeas, 129 lb. per acre.	¼ acre.
1 acre Maize Manures. Sown with Leaming Maize.	Mixture No. 1, 1½ cwt. per acre.	¼ acre.
	Mixture No. 2, 1½ cwt. per acre.	¼ acre.
	Mixture No. 3, 1½ cwt. per acre.	¼ acre.
	Mixture No. 4, 1½ cwt. per acre.	¼ acre.
1 acre Sorghum Varieties.	Early Amber Cane, 24 lb. per acre.	¼ acre.
	Sorghum Saccharatum, 24 lb. per acre.	¼ acre.
	Planter's Friend, 24 lb. per acre.	¼ acre.
	Planter's Friend, 24 lb per acre. Black Cowpeas, 12 lb. per acre.	¼ acre.
1 acre Sorghum Manures. Sown with Planter's Friend Sorghum.	Mixture No. 1, 1½ cwt. per acre.	¼ acre.
	Mixture No. 2, 1½ cwt. per acre.	¼ acre.
	Mixture No. 3, 1½ cwt. per acre.	¼ acre.
	Mixture No. 4, 1½ cwt. per acre.	¼ acre.
1 acre Millet Varieties.	Grey Seeded, 4 lb. per acre.	¼ acre.
	Red Seeded, 4 lb. per acre.	¼ acre.
	Hungarian, 4 lb per acre.	¼ acre.
	New Siberian, 4 lb. per acre.	¼ acre.
1 acre Cowpeas Varieties.	New Era, 12 lb. per acre.	¼ acre.
	Clay Coloured, 12 lb. per acre.	¼ acre.
	White, 12 lb. per acre.	¼ acre.
	Black, 12 lb. per acre.	¼ acre.

Potatoes.—The season last year was against the production of good quality potatoes ; as a result, great difficulty was found in securing supplies of good clean seed. Acre plots of eight varieties each were, however, planted at some few of the leading districts, the varieties under trial being—Early Rose, Manhattan, Brownell's Beauty, Carmen, Cambridge Kidney, Snowdrop, Southern Star, Factor, Scottish Triumph, Irish Flounder, Warrior, British Queen, Centennial, Werona Red, Anderson's Royalty, Commonwealth, and Scots Greys.

Tobacco.—Seed of nine first-class varieties was imported from a leading firm of growers in the United States, and is being experimented with in the chief tobacco-growing centres of the State. The varieties under trial are : White Stem Oronoko, Slate's Improved White Stem Oronoko, Connecticut Seed Leaf, Slate's Improved Connecticut Seed Leaf, Slate's Improved Hester, Slate's Improved Gold Leaf, Improved Sumatra, Bonanza, and Vuelta de Abaya First Crop.

In all parts of the State very great interest is being taken in this branch of the Department's work, especially with regard to the improvement in the cultivation of wheats and grasses. Some few farmers have offered to carry out experiments under the direction of the officers of the Department at their own cost.

Every opportunity is being taken to encourage farmers to go in more extensively for the cultivation of leguminous plants, either in combination with cereals or alone, with the object of improving the feeding value of the green fodder, ensilage, and hay fed to their stock, and for the purpose of increasing the fertility of their soils. Large quantities of cowpeas, field-peas, tares, &c., have been sown, with the object of distributing seed of these valuable crops next season.

The operations of the branch were, as already stated, greatly restricted by the difficulty of obtaining any quantity of pure seed of many varieties of the principal crops; but the Department is endeavouring to get over this difficulty by growing larger quantities of seed at the Experiment Farms, and by importing supplies of seed of new varieties of maize, barley, oats, peas, &c.

Arrangements are also being made to increase the staff, so that a much larger number of these Farmers' Plots may be sown during the coming season.

Plants Suspected to be Poisonous.

The Department of Agriculture has arranged for a systematic investigation to be made of plants reputed to be poisonous to stock in this State. The Chief Inspector of Stock, the Government Botanist, the Departmental Chemist, and a Plant Pathologist will work in conjunction, and the results of their investigations will be published in the *Gazette* from time to time. At present the Darling Pea, and the Wild or Paddy Melon, are under consideration.

The matter is one of great importance, especially to stock-owners, and their co-operation is asked in forwarding full information concerning the prevalence, and effect on animals, of any plants supposed to be poisonous.

The "Success" Poultry Farm

G. BRADSHAW.

In the series of articles narrating the methods adopted on suburban poultry farms, the conditions warranting such descriptions are that while there is no desire to disclose the financial results of the farms treated, they must be of known permanency.

The causes of these simple conditions were exhaustively shown in the *Agricultural Gazette* for November, 1908, on a Belmore farm, but will bear a brief and varied repetition.

Poultry farming—that is, farms devoted solely to fowls—has in this and other countries been an attractive subject for those abandoning some other industry, irrespective of whether such abandonment was due to a retirement with a competency or a failure to make a living from a previous occupation. He or she, with a moderate capital, wishing to get out into the country, and having read of the profits from hens, invested money, and through lack of experience, lost it in a few years ; or, perhaps, having saved a little from the wreck of his former calling, a man has read about the hen which in twelve months would be fed with five shillings' worth of wheat, and in the same time deliver twelve shillings' worth of eggs. A calculation was then made of how many such hens would be required to keep a family ; and not infrequently this man's all was put into the business, of which he knew not even the rudiments. The usual result was that it took more than 5s. to feed the hen, while the shrinkage in the expected egg-yield was considerable.

It is the numerous instances of these inexperienced people going into the poultry business that does the industry harm. The same thing occurs in other countries, as instanced in the following, which is an extract from a paper by Professor Graham, to the Connecticut Poultry Association. The subject was "Experiments and Experience," and went to show that even college-taught students may have but small practical knowledge, and be unfitted to successfully manage their own or others' poultry farms. "It is easy to tell a man how to swim by describing the stroke, and saying how easy it is. But what a surprise the man would get if he jumped into a river, and all he knew about swimming was what he had been told to do. The same is true of poultry. The man not only must know what to feed, but how to feed. What a difference there is in the feeding. One goes to the poultry-pen and throws in a dipper of grain. The other goes to the pen and feeds a dipper of grain. Now the proper method comes only through practice, and a certain amount of instinct, for I have seen people who could never learn to feed successfully. Many a boy comes to our College, who has never done an hour's work on a farm. He attends the classes, learns how to figure out

a balanced ration, and probably could out-talk most of us in the theory of crop rotation, but when it comes to cutting wood, handling a scythe, or even hoeing corn, about all he knows is the way in which the professor told him to hold the hoe. He has the tools, but he has yet to practise in their uses, and this especially applies to poultry.

"I believe we could keep more of our college students on our farms if we made them do more practical manual labour, rather than experimental ideas. Two years ago I sent a poultry student to Long Island to manage a farm. The owner wrote that he was a bright young fellow, but he would not try to work with the owner's equipments. He wanted a new incubator-house, a new brooder, and other up-to-date appliances which the farmer could not afford."

Professor Graham continued : "Now, if we all refused to work unless we had the best of equipments, most of us would be out of work. I often wonder if, sometimes, we are not making a mistake in equipping our colleges with such extravagant buildings and machinery, thereby setting a standard and teaching him to consider valueless such buildings as the boy is likely to have to use when he leaves us. We dwell so strongly on up-to-date methods, up-to-date buildings, up-to-date machinery, that the boy becomes—if not discouraged—ashamed of the more common or antique equipment with which he would have to be satisfied if he were to continue at home.

"The theories that are propounded at the colleges should be by men who have at some time grown chickens for the dollars and cents he could get out of them, and thus knows what he is talking about. I know it is quite a common belief that a poultry instructor's duty is to boom the poultry industry, first, last, and all the time. Such is a foolish belief, for more often than not, good is done to the industry by being instrumental in preventing the inexperienced from venturing in it."

Professor Gilbert, of the Ottawa College, Canada, on this subject of inexperience, relates the following:—"When addressing an institution, a young man, of more than average intelligence, rose and stated that he was a clerk in a broker's office, but had decided to go into poultry ; would I kindly tell him how many hens it would be necessary for him to keep, and what would be the least capital required to insure him an income of five or six hundred dollars a year? I replied : 'Young man, have you ever been in the drug business?' He said that he had not. Then said I, 'Take my advice and try that business first.'

"I recommended drugs because the law requires him to serve an apprenticeship before he can start in business, while in the chicken business there is no such requirement. The result is, it is seldom we hear of a druggist failing, and seldom we see such a man when he starts in the poultry business make it a success, because fully 90 per cent. of such poultrymen have served no apprenticeship. They prefer to buy the experience. Well, it can be purchased, but it comes high ; and I think the successful poultry instructor of to-day is actually doing better work in keeping the fool and his money from parting than he is in urging men to start in the industry, although, as

I have said time and again, there is no better paying branch of agriculture to-day than that of poultry when in the hands of competent people."

Other like illustrations could be supplied, but enough have been given to show that poultry-farming, of all other branches of agriculture, has suffered by the fact of so many people thinking it quite an easy thing to tend fowls. So it is, and there is good money being made at it too, if one only knows the way.

The proprietor of the farm under notice is one of those who graduated through every stage of the business, from A to Z; first, by feeding the fowls of an employer until seven or eight years ago, when he became the owner of one, not of its now present importance, but by hard work and attention to details bringing it to a stage of prosperity, perhaps, second to none in the State, well worthy the title modestly displayed on the several vehicles employed in the operations of the business, viz., the "Success Poultry Farm."

The Locality.

It is fairly well known that Friday of each week is the chief market-day in Sydney for poultry-farmers' products, the larger portion of the poultry and eggs being disposed of by public auction, there being four of such sale-yards. It is also a fact that on ordinary market days the sales amount to from £1,800 to £2,000, while for weeks prior to Christmas £2,500 is nothing unusual; and of either the smaller or larger of the amounts mentioned, it has been computed that fully one-half is distributed to the suburban poultry farmers, the majority of whom reside within the municipality of Botany.

There are several reasons why this locality is so favoured by poultry farmers. First, there are very large areas of sandy soil, which is the most suitable for intensive poultry culture. It is the nearest suburb, to Sydney, where land can be had in sufficient areas at a reasonable cost per acre. Being so convenient to Sydney, a load of the farm's products can be brought to the markets, and a load of feed taken home in a portion of the day. There is an inexhaustible supply of fresh water a few feet below the surface. At some of the poultry farms an iron pipe is simply driven down and a hand-pump fitted. Other farms, where the operations are extensive, have a windmill. This latter feature is a most important one, seeing that in some of the outer suburbs there have been occasions when, through want of water, the poultry farm had to be discontinued, the profits not being sufficient to cover the expense of carting the water great distances.

There are other minor causes to account for Botany being the most famed district for poultry farming, and despite the large number that at present exist, there are yet actually thousands of acres awaiting occupation for this or other purposes. Whether for pig and poultry culture, market gardening, or other branches, there is no other suburb which has such advantages in the way of accessibility to Sydney, and excellent roads; while the vast area is encircled by the Waterloo, Botany, and Long Bay tramways.

The "Success" farm can be reached either by the Botany or Long Bay tram—the latter for convenience, a 3d. fare taking one to the Maroubra-oad stopping. The road to the right is followed, and a few minutes' walk

brings one to the boundary of the Government labour farm. A half-mile further the Bunnerong-road is reached, where only a few acres separate the "Success" farm from that well-known highway.

The Farm.

Mr. R. Rhodes, the owner, was for some years engaged on a poultry farm, and realising the possibilities of duck culture, as soon as a little capital was at command, purchased the present property of 6 acres, then covered with the low thick scrub common to that and portion of the adjoining municipality of Randwick.

Mr. Rhodes, being a practical man and a keen observer of the conditions obtaining in this country, ignored the advice given in poultry books to select a high, dry, well-drained position and gravelly soil; but, like other successful Australian poultry farmers, selected a position exactly the reverse to the recommendations of the theorist. The 6 acres lie considerably lower than any of the surrounding farms. Lack of, and not the excess of, moisture is one of the handicaps to successful poultry culture in this country, a place so situated as to retain the moisture being much superior to an elevated position. No one would think of utilising marshy or swampy land for a poultry farm, but apart from this, excess of moisture need not be feared.

Fig. 1.—The Farm from Bunnerong Road.

Fig. 1 gives a distant view, taken from Bunnerong-road, of what a few years ago was 6 acres of thick scrub and other vegetation indigenous to the district.

At the present time there is a comfortable commodious dwelling, a portion of which will be seen on the extreme left of the picture. There are actually hundreds of sheds, houses, runs, and compartments to accommodate the many thousands of ducks, ducklings, chickens, and fowls. In the centre will be seen a large number of the duck-sheds and the windmill. On the left are a number of the fowl-houses.

In the foreground, being the most valuable adjunct to the establishment, is an acre of lucerne, which has been cut four or five times during the present season. Excepting the dwelling, every house, run, fence, and other structure has been erected by the proprietor and his family, the 6 acres of scrub of a

few years ago, which cost less than £200, being transferred into a property and stock valued at well nigh £2,000, and having produced a living for the family in the meantime.

These results are not the experience of everyone in the business, but perhaps before this series of articles are concluded, others equally successful will be recorded.

Houses and Runs.

The many thousands of stock produced annually on a farm like this necessitate a large amount of shelter and other accommodation. First, there are the runs and sheds for the young growing ducklings; larger spaces and houses for them as they advance in growth; still larger when they are being prepared for market. Then there are the yards and houses for the layers, and also for the breeding stock, and as these also run into thousands, the space must be considerable. Fowls also are kept, and, for numbers, require more housing accommodation than ducks.

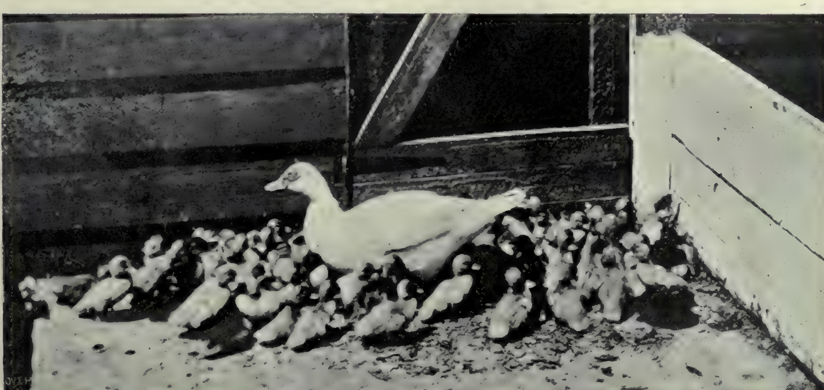


Fig. 2.—A Large Family.

The farm, as will be realised, is one of continuous growth, each year as the stock increases witnessing additional erections. Consequently, there cannot be the same uniformity in size and construction as if they had all been planned at the same time. Notwithstanding this, every house, large or small, has been built to secure the maximum of accommodation for the rather limited space at command.

For the breeding stock there are several very long, open-fronted sheds. These are divided into sections, with yard space in front for the various numbers to be accommodated. The nursery ground is the most interesting portion of the farm. The ducklings, as soon as hatched, are given—to the number of from 60 to 100—to Muscovy ducks, which make the best of mothers, being as careful of the flock, and rearing and bringing them to a stage of independence, as if she had but half a dozen. These are accommodated in long, low sheds, each duck having an apartment to herself and family, with a small run in front, divided from its adjoining one by boards about

2 feet high. Fig. 2 shows one of these small rearing apartments, tenanted by a white Muscovy duck and about seventy of a family 2 days old. It will be seen that the door of the apartment is closed. This, however, was for the purpose of taking the photograph. The doors of these apartments are always kept open, as, except at feeding time, the duck keeps her brood a good deal under cover, not through inclemency of the weather, as is the case in England, but rather to be out of the sun's rays.

This illustration on the date of visit to the farm could have been repeated over one hundred times, the only difference being that as one travelled along the runs, the ducklings were increasing in size, the last ones reached being about ready to turn out of the nursery for a more independent but brief existence.

There are actually hundreds of houses and apartments of various sizes on the farm, all excellently adapted for the different purposes; but whether for fowls, ducks, ducklings, or chickens, the principle is adopted of open fronts, Mr. Rhodes being a believer in plenty of ventilation, and affirming that close, stuffy roosting houses are responsible for many troubles in the poultry yard, by inducing roup and other diseases.

Fig. 3.—Indian Runner.

The Stock.

The proprietor of the "Success" Farm, like the majority of suburban duck-breeders, largely patronises the Muscovy breed. At the same time he says that other varieties have their merits. Fig. 3 illustrates one yard of adult Indian Runners. There are about 600 in this flock, and although Mr. Rhodes is not an exhibitor at shows, many specimens in this and other yards are typical enough to win prizes. Indian Runners are excellent layers, and occupy the same position amongst domestic ducks that Leghorns do amongst fowls. Runners are better property now than they were a few years ago, owing to the advanced prices obtaining for all poultry. At one time, when the Runners' laying period was over, they fetched as low as 2s. 6d. per pair in

the market, whereas now 5s. and 5s. 6d. are current rates. Buff Orpington ducks are also bred, there being several hundred on the farm. The proprietor says they lay well and make a decent-sized carcass for the market. The stock of those kept are of good type and colour. Pekin and Aylesbury ducks in moderate quantities also find a place on the farm. Rouen ducks are also bred considerably, but for a different purpose than any of those mentioned. Rouens are of great size, but are not renowned layers, their chief purpose on this farm being for the production of mules. In Fig. 4 will be seen a pen mated for this purpose. It contains five Muscovy drakes and about twenty-five Rouen ducks. A good view of the sheds is also seen in this picture. The object of this mating is to overcome the difficulties experienced with Muscovies when bred pure, viz., the ducks grow to little more than half the size of drakes, and when marketed fetch little more than half the price. The hybrids resulting from this cross show no sex difference

Fig. 4.—A Mule Breeding Pen.

in size. They grow fast, and are usually of a brown colour, the ducks fetching as much in the markets as the drakes. Questioned as to what sort of layers the mule ducks are, the reply was, "We never try them. Their eggs are so small that they are not worth keeping for their laying properties. We only breed the mules for the market value of the carcass."

While the above varieties and mules are bred in hundreds on the farm, Muscovies form the principal stock, they being produced in thousands. The drakes of this breed grow, in fourteen to sixteen weeks, up to 10 lb. or 11 lb. weight; and just as wheat is the principal grain crop, so are Muscovies the principal crop of the suburban poultry-farmer, this arising from the fact of there being an excellent demand for them every day in the year. Even the one-time patrons of the goose now give preference to the young Muscovies, through their size, tenderness, and general superiority.

Fowls, principally Leghorns and a few Orpingtons, are also stocked, but not to the same extent as ducks. The nature of fowls is such that they do not thrive so well in large numbers as do ducks, while larger runs have to be provided.

On the right-hand side of Fig. 1 will be seen several of the fowl-houses, and poultry in the distance, while Fig. 5 will give a good idea of the type of the laying Leghorns.

It may be here mentioned that among the many thousands of stock on the place, disease was not even remotely evident.

Fig. 5.—The Laying Leghorns.

Hatching.

Nowadays we hear a good deal about up-to date methods in agriculture. Farm buildings, machinery, and other equipment must be of modern design, and the stock, if not prize, at least of pure blood. So far as the successful poultry farms about Sydney are concerned, the proprietors favour pure breeds of fowls and ducks, but numbers of them will have nothing to do with incubators.

On a farm, such as the one under notice, with between 3,000 and 4,000 ducklings on the place, many would think machines an absolute necessity. Fortunately, such is not the case, for, if it were, about twenty 200-egg machines, and their necessary appurtenances—foster-mothers, or brooders—would also be required, involving a capital cost approximately of £250. In addition, the entire labour of one man would be required to attend to turning and cooling the eggs, lamps, hatching, re-filling incubators, and otherwise attending to them, and while the system of artificial brooding is, in

some hands, carried out successfully, in the majority of instances, through various causes, many deaths occur, which would not take place under the natural mothers.

The hatching is all done by Muscovy ducks, Fig. 6 showing the system. The illustration shows but a small portion of the space devoted to the hatching. There were between 300 and 350 sitting on the day the photograph was taken. One of the long sheds previously referred to will be seen, under which is a continuous row of nest-boxes, each tenanted with a Muscovy duck, the eggs being in various stages of incubation, from one day to others with the ducklings just emerging from the shell. In front of these is another row, with an aisle or passage-way between, the fronts of each facing.

The ducks at their own time and occasion come off their eggs, feed and drink along this passage, and return to their nests. The nesting material is

Fig. 6.—The System of Hatching.

of the scantiest, but in a few days after the eggs are placed under the Muscovy, the nest becomes filled with the feathers from her body, and when coming off the nest, she covers the eggs with them.

The number of eggs placed under each varies from 15 to 20 or more, and it is nothing unusual for the entire number to be successfully hatched. In the busy season there is scarcely a day but from six to a dozen clutches of ducklings are coming off. If the smaller number the whole lot are given to one duck to brood. When more than this number are due they are divided between two. Fig. 2 shows one of these manifold broods.

In the poultry farms previously described in the *Gazette*, the proprietors of each intended them to be for the purpose of making money rather than show places, and to that end their first efforts were to keep down expense, the houses, &c., being largely constructed of second-hand material.

At the present farm the five or six hundred nest-boxes alone would come to a considerable item had they to be made from new timber. Rather than this, the cost has been but a trifle. The majority of them are old kerosene tins, cut from lid to bottom. They are then opened out, and nailed to two pieces of board which form the ends.

These will be seen in the back row of Fig. 8, in front being second-hand butter boxes. In every way there has been the strictest economy, which is the first thing to success in like undertakings

Fig. 7.—Getting ready for Market.

Rearing, Feeding, &c.

The ducklings, when hatched, are given to a mother duck and placed in one of the compartments shown, the first food being pollard and bran mixed with soup. In two or three weeks chopped lucerne is added to the above. This constitutes the chief food until marketed.

Water is laid on in every run on the farm. It is allowed to drop slowly into a trough or other receptacle, just sufficient for the wants of the respective flocks; thus ensuring it being always fresh. The water is raised by windmill, thus saving much labour. In the case of the very young ducklings, small fountains are used, constructed so that the ducklings cannot get into the water. At 3 or 4 weeks old they are removed from the mothers and drafted into larger yards, where they are prepared for the market. Figs. 7 and 8 depict these, there being over a thousand in one flock and several hundreds in the other. It is from these flocks that the supply is taken, from fifty to one or two hundred being marketed each Friday. Their places are filled by further drafts, the supply being thus kept up for a large portion of the year.

The chickens are all hatched and reared by hens, the fertility of the eggs the present year being good, and there having been very few losses either through accidents or disease. Except that they get less meat, the fowls are fed the same variety of food as the ducks, viz., pollard, bran, and meat, mixed with soup, hotel waste, and lucerne. The stock of fowls on the farm usually runs to about 1,000. The numbers are, however, considerably larger in the breeding season.

Fig. 8.—But a few weeks to Live.

Marketing.

There are two systems of selling poultry products in Sydney—by auction on Tuesdays and Fridays, or by sending to one or other of the Sussex-street produce houses.

The latter method is, however, utilised largely by the coastal consignors. The Sussex-street firms meet the respective steamers, take delivery of the coops of fowls and eggs, place them on their floors. The city poulterers come along and make offers for the fowls according to the quality, the best offer securing them. Eggs find another class of buyer, mostly the suburban grocers, who drive in on Fridays and secure their requirements.

There are four poultry auction rooms, all situated conveniently to the Haymarket, and frequently termed the Railway saleyards.

The bulk of the goods disposed of this way is suburban-reared, or railway stuff. The suburban farmers bring the goods in on their own vehicles, and usually take a load of bran, pollard, or other feed home with them. As a

number of them bring their eggs in twice a week, they realise the highest prices and have the trade name of "new-laid" as distinct from "fresh" eggs, "railways," or "rivers."

The majority of the suburban men grade their eggs into two sizes, those under 2 ounces being termed pullets eggs, and fetching from 2d. to 3d. below the large ones.

This does not obtain with duck eggs, they being of great size, and few small ones among them.

Mr. Rhodes markets his produce at one or other of the auction rooms. As soon as his products are reached the reliability for size and freshness is such that the auctioneers invariably let it be known that they are Rhodes' eggs, the top market price being secured in about two bids. The same applies to his Muscovies. Top quality is produced, and the highest market rate of the day is always obtained. Mr. Rhodes did not volunteer what quantity of eggs he gathered daily, but from the appearance of the morning's collection there should be between forty and fifty dozen, this being apart from the heap shown in Fig. 9.

Fig. 9.—A Midday Collection

Ducks usually lay at night, and the eggs are collected in the morning, but some are laggards and lay in any place in the runs during the forenoon. Those shown are the second collection of the day. Shortly after being gathered, the eggs are washed and placed on a wire frame to dry.

It was during this process the photograph was taken. The fine size of the eggs is apparent.

General.

In an establishment such as this, it will be readily understood that a great deal of manual and other labour is necessary.

It would be difficult to compute the number of tons of food consumed weekly, which, with the exception of lucerne, has to be brought by vehicle from Sydney. Fig. 10 shows a two-horse waggon leaving the farm for feed, which it does every working day of the year. Hotels, clubs, &c., are visited each day, the very best of ducks and fowls' food being thus procured. Two

vans are also on the road almost daily, either carting produce to market or visiting the mills for cereal foods. Altogether, four horses are required for the farm's operations.

The manual labour is done by three adults, but the smaller members of the family also assist in the minor jobs.

In addition to the stock mentioned, Mr. Rhodes also keeps about twenty-five pigs. These consume the rougher portion of the foods, and with the excellent price for pork, should contribute largely to the prosperity of the place.

Fig. 10.—Leaving for Sydney.

Regarding the financial aspect of the farm, it is sufficient for the writer's purpose that it is one of the small places which grew big. What profit the owner makes is his own private business. One thing, however, I have authority for saying. The place was commenced seven or eight years ago, with not too much capital. Since when the owner has brought it to the state described, and has just returned from a second visit to England, accompanied this time by a relative who purposes going into a like business, and, with the present example, there is scarcely a doubt but in a few years there will be another "Success Poultry Farm" worth recording.

Hawkesbury Agricultural College and Experiment Farm.

Feeding of Pigs.

[Continued from page 812, Vol. XIX, 1908.]

H. W. POTTS.

XI.

Peas, Clovers, Pea-nuts, Rape.

Peas cannot be successfully grown in many parts of this State, but there are districts in the Central and Southern Coastal areas, as well as on the Tablelands, where heavy crops are grown during the winter and early spring, and where moisture is fairly abundant and the summer late. Sowings are made in those districts from April to July. As a food for pigs, peas are especially valuable; and where conditions permit, this crop should be more in favour than it is. This is owing to the relatively high protein content. An average sample should contain, approximately :—

Water ...	15	per cent.	Fat	0·8	per cent.
Ash	2·4	,,	Fibre ...	7·9	,,
Protein ...	23·7	,,		———	,,
Carbohydrates	50·2	,,		100·0	,,

Peas, as green fodder, either alone or with oats or barley, form a forage that is highly relished by pigs. The dried hay is useful, and the dried peas can be given in many ways in the ration. It always acts as a cleansing agent for subsequent crops, and it invariably leaves the soil richer in nitrogen. Few foods equal peas when judiciously associated with other foods in producing a well flavoured, good textured pork and bacon. It provides a well balanced mixture of lean flesh with fat. This is in constant favour with the curers and consumers. It was found at Wisconsin also, that young pigs fed on peas had bones 26 per cent. firmer than others.

Pigs will eat peas, pods, vines, and roots at all times with a relish, provided the crop be not over ripe or too harsh. The best time to turn the animals into a crop is when the seeds in the pods are fully formed.

Comparative tests conducted in the United States and Canada have proved that 1 acre of peas produced more pork and of a better class than 1 acre of maize.

It is not wise to feed peas alone, particularly to young pigs. It renders them unthrifty, and there is a tendency to check growth. In all cases they should be given with barley, maize, or other cereals, milk and potatoes. At Ottawa it was shown that 3·33 lb. peas fed with 2·35 lb. skim milk produced 1 pound of pork.

In mixed farming a pea-crop seldom enters into the regular rotation, but there should be no reason why it should not do so in replacing other leguminous crops, such as cowpeas, vetches, clover or lucerne. Peas will renovate soil in the same way, and prove useful as such between two cereal crops. Like other legumes, peas thrive best on calcareous soils, although any soil found suitable for oats will usually raise peas. As a rule, the plant does well on light, shallow soils. The tap-root contents itself with a less depth of soil than beans or cowpeas—strong clay soils or stiff loams are not suitable.

It is a common practice to grow a few beans in the crop to enable the leaf-tendrils of the pea to obtain support, and assist the crop to climb. When the land is poor it may be fertilised with 2 cwt. superphosphate to the acre, or if the soil be deficient in lime, it should be dressed a few months prior to sowing with 4 cwt. gypsum to the acre. There are numerous varieties of peas to select from. We found the Canadian White Pea, and the Canadian Golden Vine, very prolific; also, another variety, named Suntop. The ordinary gray field pea has also given good returns. The yield has been as high as 24 bushels of seed to the acre.

The crop matures in from 80 to 100 days. The seed germinates freely at low temperatures. In order to gain adequate moisture it is best to sow early in autumn, during the wet season. The seed may be broad-casted or drilled in well-tilled soil.

In the former case as much as 2 bushels to the acre may be used, followed by disc harrowing. With the drill 10–15lb. to the acre are required. Sow 2 inches deep in drills, and 24 to 30 inches apart.

The vine-like and prostrate habit and growth of peas, and the freedom with which the drying and dried pods open and lose their seeds, render harvesting a crop tedious and difficult. The time to select for cutting is when the lower pods are matured and yield readily to thumb pressure. This is about the time that two-thirds of the crop is yellow.

A mowing machine is usually employed to cut. Difficulties may be experienced owing to the trailing nature of the plant. Men are required to follow with forks to pass to bunches on one side and clear the track for the machine's next round. The vines may be turned once or twice to dry.

Clovers.

The clovers are always recognised as nutritious fodder plants owing to their high protein content and palatable flavour. They are highly useful when introduced in the pastures. For this purpose, the most sturdy and certain grower is the White Dutch Perennial (*Trifolium repens*). Owing to its special root habit it is enabled to withstand the most trying periods of drought, and is hardy enough to resist influence of couch and other strong-growing grasses. It is the most certain of all clovers to retain a permanent place in the pastures of either native or introduced grasses, and as such adds protein to the fodder and narrows the nutritive ratio. Besides this, wherever clovers are induced to take a permanent place in pastures, they renovate them through their power to assimilate nitrogen from the atmosphere.

Where moisture is sufficient, with good soil and favourable climate, the perennial red clover, or cow grass (*Trifolium pratense perenne*), may be successfully grown. This serves a useful purpose in feeding brood sows as hay, fed with cereals.

Pea-nut, Earth-nut, Ground-nut or Ground-pea.

This legume is being introduced not only as an edible nut for human consumption, but also for use as a fodder for stock, and as a soil renovator. It grows about a foot high, is creeping in habit, and as the flowers grow the stems curve downwards towards the soil which they penetrate, and eventually the seed-pod ripens underground. For feeding pigs the Spanish variety affords the best class of nut and forage.

The plant thrives well in light, sandy soils, although it will accommodate itself to clay loams and rich chocolate loams. In fact it will grow well on any good agricultural land. The soil should be well cultivated. Like all the legumes, it responds best after a light application of lime. Where manure is required, the best is farmyard manure, or a complete fertiliser including nitrogen, such as that recommended for lucerne.

The seed should be planted in rows, 3 feet apart, with the seed 14 inches distant. Sow in September and October. As soon as the plants appear, cultivation should follow to keep down weeds and conserve moisture. In doing so, leave the soil loose, friable, and ridged towards the plant in order that the flower stems may readily force their way downwards.

When ripe, the plants are raised, the soil dusted off the pods and roots and piled into ricks to dry. The dried hay is equal in food value to clover-hay.

The peanut, or kernel, contains large proportions of fat and protein, and hence is of exceptional feeding value. The average composition shows :—

Protein, 28 per cent.
Fat, 16 per cent.
Carbohydrates, 15 per cent.

The yield per acre ranges from 35 to 60 bushels.

This class of pig feed is attracting considerable attention in the United States, and our experience points to the importance of growing the crop here on an extended scale. Tests were conducted at Arkansas and other experiment stations, where pigs were fed on peanuts, and the gain per day in forty-six days averaged 0·57 lb. pork. The returns from a quarter of acre of peanuts gave 313 lb. of pork, while a like area of maize in grain produced 109 lb. of pork. A sole diet of peanuts produced a soft, oily quality of lard and an inferior class of flesh. This was corrected by the addition of maize to the ration. 140 lb. peanuts with 190 lb. maize, gave 100 lb pork. Pigs relish this class of fodder, and will eat the plant during any stage of its growth, or when cured.

Rape.

The rape plant is closely related to the cabbage and turnip. Next to lucerne it affords the most nourishing, succulent, and relishable crop on which to graze pigs.

This fodder, so far, has not received the attention it merits from sheep owners and pig breeders. It will surely become more popular as its properties in the feeding of those animals are better known.

The growth of the crop is best encouraged in a moderately cool and moist climate. Good yields have been obtained on the coastal areas of this State, and on the cooler portions of the Tablelands throughout spring and the early parts of summer. It provides a useful and paying catch crop in the rotation, especially between cereal crops. The plant responds vigorously to cultivation and manuring. The roots resemble those of the cabbage, whilst the leaves are like the turnip in fleshiness, smoothness, size, and succulence.

The variety which affords the highest returns, under adverse conditions, is the Dwarf Essex.

The experience we have acquired in growing the crop for the past ten years points to it as being the most reliable and payable crop to grow for pigs during the winter months.

It grows best on rich, moist, loamy soils. Excellent returns are obtained from light, sandy loams, as well as stiff, clay lands.

A certain crop is assured on recently-reclaimed swamp lands. It also grows freely on virgin soils when the turned-in sod has been allowed to remain long enough to decay.

In the case of growing rape as a virgin crop, deep ploughing is essential. In every case the land must be brought into a fine condition of tilth with plough, harrow, and roller. The use of the roller is especially urged in areas with a light rainfall, to compact the soil and check evaporation. In all cases the soil should be lightly harrowed after the roller to form an earth-mulch. The seed is small, and hence a fine, moist, seed-bed is required to ensure rapid and full germination. Sowings may be made according to soil, locality, and climate, from the latter part of February until the end of May. Crops will be ready for grazing off, or cutting, in periods ranging from eight to twelve weeks, and yield from 6 to 20 tons per acre. It is not feasible to absolutely determine the advantages to be derived from sowing in drills in contrast with broad-casting. Our experience indicates that when the season is moist, a broad-casted crop makes better and more rapid growth than a drilled one. It must be borne in mind, however, that where the rainfall is scanty, shallow cultivation is needed to check evaporation, and that can only be conducted in a drilled crop.

The quantity of seed per acre for a broad-casted crop is 7 lb. to 10 lb.; with a drilled crop 4 lb. is sufficient. Drills, 3 feet apart, allow room for a horse in the work of cultivation. Better yields have been gained from drills 2 feet apart.

The cost of ploughing, rolling, and harrowing, the seed, fertilisers, and planting and cultivation of a broad-casted crop, is approximately estimated at £2 4s. 6d. per acre; a crop in drills 3 feet apart, £2 8s. 9d. per acre ; and 2 feet apart, £2 12s. 2d. per acre, and of this amount, in each case, 22s. per acre is for fertilisers.

A maize drill can be used for sowing, with a plate containing the holes of correct diameter. A wheat drill can be improvised for sowing, by blocking the tubes to sow in drills the correct distance apart. It is stated that pigs feed better from the drilled crop, seeing they do not trample it down ; and that the leaves are more juicy. The plant will grow 18 to 22 inches high. Where a fertiliser is required the following should be applied :—

Nitrate of Soda	...	...	37 parts.
Dried Blood ...	...	...	33 ,,
Superphosphate	...	...	180 ,,
Sulphate of Potash	...	...	60 ,,

Of this mixture use 2 cwt. to each acre.

Rape is considered one of our best catch crops. Its deep root system enables it to break up and penetrate the subsoil. Air and moisture are admitted, phosphoric acid and potash are released and taken to the surface ; the land is kept clean and free from weeds. Pigs turned in to graze the crop, manure the soil, and this, with the roots of the plant, is ploughed in and renders the land fertile and ready for the main crop to follow. Where the rape is cut, it is often possible, with a fair rainfall, to grow a second crop.

A series of experiments was conducted at the Wisconsin Experiment Station to ascertain the feeding value of rape for pigs, and the results are thus summarised :—

"That with pigs from 4 to 10 months old, representing the various breeds of swine, an acre of rape, when properly grown, has a feeding value, when combined with a ration of maize and bran, equivalent to 2,436 lb. of a mixture of these grain feeds. That rape is a better green feed for growing pigs than good clover pasture, the pigs fed upon rape having made on the average 100 lb. of gain on 33·5 lb. less grain than was required by the pigs fed on clover pasture. That pigs are more thrifty, have better appetites, and make correspondingly greater gains when supplied with a rape pasture in conjunction with their grain feed than when fed on grain alone. That a plot of Dwarf Essex forage rape, when planted in drills 30 inches apart early in autumn, will yield three good crops of pasture forage in a favourable season. That rape is the most satisfactory and cheapest green food for swine that we have fed. That every feeder of pigs should plant each spring a small field of rape adjoining his pig yard, and provide himself with a few rods of movable fence, to properly feed the rape to brood sows and young pigs. That rape should be sown for this purpose in drills 30 inches apart to facilitate the stirring of the ground and cultivation after each successive growth has been eaten off. That pigs should not be turned upon a rape pasture until the plants are at least 12 inches to 14 inches high, and that they should be prevented from rooting while in the rape feed. That rape is not a satisfactory feed when

fed alone when it is desired to have any live weight gain made in pigs, though it has been found that they will just about maintain themselves without loss of weight on this feed alone."

It must be noted that in no instance is it advisable to depend on rape alone as a fodder for fattening pigs. Young pigs do well on this class of fodder up to the stage when they have to be fattened. This class of green feed distends the digestive tract and renders it better able to digest a food richer in carbohydrates, such as maize, barley, pollard, skim milk, or other foods which may be given with rape to fatten.

It is also well to remember that when stock are first turned in to graze on rape it is very laxative and liable to cause scouring. This means that until the animal becomes accustomed to the new diet it should be given only a few hours daily.

Rape is very juicy owing to its high-water content. This varies from 89 to 94 per cent. The albumenoid ratio is about 1:3·37.

Argemone mexicana.

Touching the reference to this weed, page 829, *Agricultural Gazette of New South Wales*, October, 1908, Mr. A. R. Samuels, Dubbo, writes:—

The diversity of opinion of the Farmers' Congress, as quoted from the *Cape of Good Hope Agricultural Journal* of April, 1908, is in itself condemnation of the *Argemone mexicana* as a fodder plant. The principal reason for wishing it withdrawn from the list of noxious plants was because it is not injurious, but even, in certain seasons, serves as food for stock.

From my own experience it is worthless as a fodder plant and shunned by domestic stock as well as rabbits, and the native fauna do not take even an "odd nibble" at it.

The seed is chiefly distributed by its seed following the watercourses. It is already flowering and ahead of other weeds, costly to keep under, and in many places along the river growing breast high.

I might also mention here, that I have noticed the weed flourishing along the Dubbo-Coonamble railway line, where the seed has been carried with ballast from the Macquarie and Castlereagh Rivers, much to the annoyance of settlers through whose properties the line runs.

It may be fairly conceded, I think, that the Yellow Poppy has not a redeeming quality to recommend its preservation as a fodder plant in New South Wales.

Cheese-making in New South Wales:

Its Whys and Wherefores.

M. A. O'CALLAGHAN,
Dairy Expert.

When the Australian States federated, and New Zealand stood out, I drew attention to the great opportunity which presented itself to New South Wales dairy farmers to develop cheese manufacture, so as to take the place in Australian trade hitherto mainly occupied by New Zealand cheese, but now barred by the extremely heavy duty of *three pence per pound.* At the same time I suggested to the then Minister of Agriculture the advisability of appointing a first-class practical cheese-maker, who should devote all his time to instruction in the manufacture of high-class cheese. The result has been very satisfactory to an extent, for the cheese instructor, Mr. W. Graham, has been instrumental in raising the standard of many private makers and factories, but still there is room for much improvement in the way of quality and quantity. We do not yet make sufficient cheese to meet our own market requirements, although the price for cheese has been much better than for butter, comparatively speaking, since the formation of the Commonwealth.

Quality.

Those makers who last year sent cheese to London, as an experiment to test the English market, demonstrated quite clearly that New South Wales can turn out Cheddar cheese second to none other. The Kameruka Company and Messrs. Styles and Manning, of Bega, sent cheese to London that quite held its own for quality and price with best New Zealand or Canadian. At one time it was thought that good cheese could only be made on the far South Coast of New South Wales; but with such manufacturers as Mr. Binks, of Berry, the Wingecarrabie factory at Bowral, Messrs. Wilson and Perkins at Tenterfield, Mr. Wright at Mudgee, Mr. Ainsworth on the Richmond River, Messrs. Isaac Bros. at Tumut, the Hawkesbury College at Richmond, and the Wollongbar State dairy farm at Richmond River, it has been demonstrated that excellent cheese can be made, practically speaking, all over New South Wales. It was thought by many that the climate of the Richmond River would prevent the manufacture of a high-class cheese, but the Wollongbar State farm some years ago showed that the upland pastures of that district produced a milk highly suitable for the manufacture of first-class cheese. As a matter of fact, the climate has nothing to do with the principles of either cheese or butter making. These principles are the same throughout the world, and it is only a question of ability to govern temperature, and thereby fermentation, that we have to consider. This brings me to a consideration of the whys and wherefores of Cheddar cheese manufacture. Science to-day demonstrates a satisfactory reason for every stage in the technique; and if we

understand the reasons why certain things are done, it goes without saying that we shall more readily grasp the necessity for any slight alterations when the conditions are variable. We can start out with the main fact that the rennet must be added to the milk before fermentation (ripening or souring) has proceeded beyond a certain limit, and that when that limit has been passed the cheese-maker's task is hopeless from the point of view of quality. This refers to all cheese-making, but our present interest lies in Cheddar, as it is, practically speaking, the cheese of Australian consumption, and the import cheese of England. We demand a milk for this purpose delivered in the cheese-vat showing not more than 0·2 per cent. of lactic acid, and also showing no bad taints or gassy fermentations. Let us see what this means, and how the desired result is to be brought about. We will begin at the cow.

Feeding in the Bails during Milking.

The less disturbance there is in a cow byre during milking the better, not only from the point of view of milk yield and butter-fat, but also from the point of view of cleanliness. Cattle always make more or less of a disturbance when feeding, and if the food is at all of a light dry character, such as chaff or hay, the dust therefrom gets distributed by air currents throughout the cow-house, and a certain amount of it finally finds its way into the milk-pails. This food débris is not good for the cheese or butter maker, and hence the advisability, generally speaking, of not feeding cows during milking. Gassy curd may sometimes be traced to bacteria introduced in this way.

Food.

If the cow's food is highly flavoured through any cause this flavour will show up in the milk. Hence plants that give forth strong flavours when bruised or tasted, like turnips, wild carrot weed, wild mustard, green lucerne, green trefoil, &c., should have no place in the fodder of the cheese-maker's cow. If cattle are given access to any such plants they should be removed from the possibility of obtaining them some hours previous to milking, but even then the result will not be first class. The food of the cheese-maker's cow should be sound pastures, green fodder, or well-preserved silage (maize or sorghum).

Animal Odour and Aeration.

Apart however from the effect of injurious foods, all animal secretions partake more or less of what is known as animal odour, and to remove this, as well as to promote a healthy fermentation, all milk for cheese-making should be passed over an aërator, in a pure atmosphere, as soon as possible after being drawn. Passing milk over an aërator splits it up into thin streams, allowing the animal odour to pass away, and allowing the milk to come into contact with pure air, the oxygen of which hinders the development of many injurious bacteria.

The Control of Souring or Ripening.

Immediately the milk leaves the practically sealed vessel of the cow fermentation begins. The variety of fermentation depends on the species

and number of bacteria that gain access to the milk. The only fermentation that the cheese or butter maker desires is the normal ripening or souring brought about by lactic acid producing germs, and even this must be properly controlled if we are to avoid failure. Milk begins to smell sour when about 0·25 per cent. of lactic acid has been formed, and then it is too late for high-class Cheddar cheese manufacture. The rapidity of milk souring practically depends on two things, viz., the number of lactic acid producing bacteria present in it, and the temperature at which it is held; of course assuming that no preservative (bacteria poison) has been added. We can always be assured of a large number of lactic acid germs being present wherever milk is met with; in fact, these microbes are almost ever present in the milk duct of the teat (the trace of milk that remains behind after each milking sufficing for food), and they are thus washed into the milk-pail with the milk. Given then the milk, and the lactic acid germs, the next item is that of

Temperature.

When the milk issues from the cow's udder it is about 100° Fahr., and from this down to say 70° Fahr. is a range of temperature at which bacterial life develops very rapidly indeed. Every farmer knows how soon meat, fish, &c., goes bad on warm summer days in New South Wales. The same cause that enables putrefactive bacteria to quickly decompose these substances will enable ordinary milk bacteria to rapidly cause it to become sour. Hence the dairy farmer who wishes to supply milk for cheese-making, or for condensing, must cool it, by some means, as soon as possible after it has been drawn from the cow. Aëration, as referred to above, will bring about cooling to some extent, but by passing cold water through a tubular aërator the milk can be cooled and aërated in one operation. If, however, the farmer makes cheese at his own dairy, it will only be necessary for him to cool the night's milk, for he will start to make his cheese—it is presumed—as soon as the morning's milking has finished: aëration of course proceeding as the milking goes on. By a little judicious observation and arrangement the cheese farmer will soon find out how long he should cool the evening's milk so as to have it ripe enough to start cheese-making in the morning, without allowing it to be overripe.

Other Bacterial Decompositions or Taints.

So far, we have been assuming that our farmer is a first-class one, and that his milk is not likely to be affected with the decompositions caused by putrefactive germs, which of course only occur to any extent when milk is produced under unclean conditions. All manure, animal excreta, &c., of the farm-yard is decomposed by microbes. These putrefactive varieties should not be allowed access to milk, but if pieces of manure, &c., get into the milk, myriads of these injurious bacteria are borne in therewith. The cheese farmer then, above all others, must be scrupulously clean in all his operations: his cattle must be milked in clean bails, the udders should be cleaned before milking, the milker's hands should be washed frequently, all utensils should be thoroughly scalded, the cows should have a clean place to rest during the night, and above all things they should only have access to

A Pure Water Supply.

Without this latter all other work will not avail. Water enters largely into the work of the cow. Her milk is more than four-fifths water, and even her flesh is three-quarters water. Hence she must take a considerable amount for drinking purposes, and, if this is stagnant, she will not only refuse to take sufficient for large milk production, but what she will take will cause her milk to be ill-flavoured. Stagnant pools, however, are another source of trouble; when cows walk into these they come away with unclean bodies; the water soon dries, and when the animals are being milked in the evening or morning, the dust from their bodies, or, in other words, the mud from the pools, drops into the milk-pail. This is the most fertile source of what the cheese-maker most dreads, viz., an active gas-forming fermentation in the cheese-vat during manufacture.

The Manufacture.

Having got the milk (morning's and evening's) in the vat, the manufacture proper begins; and no matter how well the operator may know the technique of the business, unless he knows the causes of the different variations that daily occur, he will not be able to intelligently grasp the situations arising, and alter the technique to suit the conditions prevailing. No two days' milk have ever worked exactly alike in the cheese-vat, and hence the reason for close observation and large experience before a cheese-maker can be truly called expert.

Let us see what is the cheese-maker's object? He wishes to recover all the solid matter possible from the milk, and to incorporate with these milk solids as much of the watery part as is consistent with high-class quality. The whole has to be obtained in a condition which will fit the green cheese for undergoing a gradual fermentation or decomposition, resulting in a food easily digested, rich in nutrient matter, and pleasant to the taste. It must be here pointed out, however, that there appears to be a good market in Sydney for semi-ripe cheese, and it is difficult to account for this peculiar taste, because not only is such cheese not palatable, but it is very indigestible. Habit breeds some extraordinary results; and no doubt this peculiar custom of eating semi-green cheese of a soapy character is due to the fact that for many years the quality of New South Wales cheese was mostly of this inferior kind, and the cultivated tastes of the people who could not afford to pay special prices for imported cheese now fail to recognise the benefits of a superior well-ripened article, and hence do not generally demand it. The best article, however, finds plenty of buyers at satisfactory prices, and no doubt it is only a question of time when our people will, as a whole, demand a well-cured cheese; and as it is only first-class manufacture that will stand slow and gradual curing, so the necessity will increase to produce a tip-top raw material.

The different processes of manufacture are all based on sound scientific facts, and hence are easily accounted for. Rennet is added because it has contained in it a ferment that quickly coagulates milk. The milk is brought

to a warm temperature, about 84° Fahr., for renneting, because it is necessary that bacterial development shall proceed rapidly so that lactic acid shall be formed. This vigorous lactic acid fermentation is required for a double purpose, viz., so that lactic acid bacteria will crowd out any few adventurous germs of an injurious nature that may have gained access to the milk, and also because the lactic acid formed helps even in the early stages to get rid of the excess moisture in the curd. The curd is cut to allow the unnecessary whey to escape. It is cut into certain sized even cubes, the size being determined by the amount of moisture it is desirable to have in the finished cheese. It is important that the cubes should be as nearly as possible of one size, so that when heat is applied later on the temperature shall affect all alike, thus producing an even cooking. If some cubes were quite large compared to others the centres of the large cubes would not be so warm as those of the smaller ones, and therefore an uneven development of lactic acid would also ensue, and an uneven cheese would result. On the other hand, if the cubes are cut too small, not only will a lot of the fat that is locked in be set free, but the cooking will proceed much more rapidly than usual.

Cooking.

This is the term given to the heating of the curd in its own whey by the application of hot water, or steam, to the sides of the usual jacketed vat. This heating must be brought about very slowly at first as a general rule. If the cooking was done very quickly, the tough film formed on each cube would be produced too soon, and then the unnecessary moisture could not be expelled without breaking up the cubes, and thus causing a loss of butter-fat. The good cheese-maker sees that the cooking keeps pace with the lactic acid development. The one thing contracts the curd, expelling the moisture, and the other forms a little skin on the cube to retain fat and moisture. When a certain stage of acidity has been developed, the whey is withdrawn, so that the further development of acid can be better controlled, as, of course, with the withdrawal of the whey, not only is the largest percentage of the germs removed, but the sugar which acted as their food also passes away in the whey, so that development now proceeds much more leisurely, and, practically speaking, the critical part of the work is over. If through any reason (such as the presence of gas-forming organisms) the production of lactic acid is too slow, the curd must be left in the whey longer than usual, so that the development of lactic acid producing germs and their work will be helped in every way possible.

Gassy Curds.

As already stated, this gas is formed by undesirable germs in the milk. Now, certain forms of bacterial life exhibit great antipathy to others, while many do not thrive at all in the presence of acid. These are the two reasons why we desire to specially encourage lactic acid forming bacteria when gas-forming bacteria have got into the milk. The latter do not grow well in the presence of acid, and as the acid production increases, so the gas production decreases, and thus we set one microbe to check another.

Conservation of Fodder.

GEORGE MARKS,
Instructor of Agriculture, Hawkesbury Agricultural College.

THE dry seasons of the past, and the absence of feed in many parts of the State, have brought home rather forcibly to stockowners the importance of conserving fodders during good seasons as the only safe means of guarding against losses which must arise when the summer crops fail, as they will do from time to time in the future. There are probably no operations associated with farm practice of greater importance than the growth of fodder crops. The peculiar climatic conditions do not allow of too much reliance being placed upon the supply of natural foods, and with such a vast area devoted

Making Bush Hay on Edgeroi Station.

to pastoral purposes it is not only necessary to make provision for a continuous supply of food, but it is also desirable to study the requirements of the animal economy, and utilise those crops that will best meet those demands. Amongst the varieties useful for stock use there are those adapted to almost every part of the agricultural area of the State, and in addition, much may be done in the direction of making use of the natural grasses.

Fodders may be conserved in two principal forms—hay and silage. Hay may be defined as the conserving in the dry form ; silage in the green and succulent condition. As silage has been so fully dealt with by several writers in the *Gazette* recently, it is unnecessary to again refer to it.

Hay.

Hay-making admits of many variations, but throughout, whether it is intended to consume the product on the farm or dispose of it in the open market, there are principles which must be observed to ensure the making of a good product. Some of the operations may appear to be very simple and unimportant, but the non-observance of such frequently leads to deterioration.

Suitable Crops.

Any plants which stock will eat in their natural condition, and which allow of quick and easy drying, may be converted into hay. Those principally used for this purpose are wheat, oats, lucerne, millet, and grasses. Thick-stemmed crops, as maize and sorghum, do not admit of easy drying. They are best preserved as silage. To make a good sample of hay, cutting hould take place when the crop is in the best condition, and the subsequent operations carried out with the view of avoiding unnecessary waste, and preserving a nice, bright colour.

When to Harvest.

Opinions differ with many people as to the proper time to harvest. With some the grain is allowed to be fairly well matured, others prefer to cut on

Stacking Bush Hay at Belmont Park.

the younger side. One general principle may be laid down for cereals, and that is to harvest when the maximum green growth is reached, which is after flowering, and when the seed is in the doughy or glazed stage. In this condition the heaviest yield is obtained, and the plants contain their highest proportion of food nutrients. As the result of numerous tests, it has been found that the best condition to cut lucerne is when about one-tenth is in flower. The first and last cuts of a season do not flower, in which case they are harvested when they have attained their maximum green growth. Many of our grasses make splendid hay, provided they are not allowed to get too ripe. A number of native species develop a fair amount of fibre on approaching maturity, which renders them less palatable, and they contain a considerable portion of indigestible matter. They must be cut at the flowering stage. Where there are mixtures, harvest when the bulk, or the best, are in flower.

In the Western districts, there are large tracts of country perfectly level and free from obstructions, where mowing machines may be used without difficulty. In good seasons immense quantities of valuable grass-hay could be saved with no other trouble than the cutting and carting, while the removal of such, especially in the vicinity of homesteads and farm buildings, would assist in lessening the dangers arising from fires.

Drying.

The time occupied in drying depends upon the succulence of the crop and the weather. Hot, dry weather is naturally the most suitable for hay-making. After cutting, wilting takes place. Too rapid drying is generally accompanied with crumbling and loss of leaf, especially with lucerne. From

Stack of Bush Hay at Belmont Park (side view

one to three or four days are usually required. Loose hay is raked into windrows when wilting has commenced, and then forked into cocks, shaking it out well, so as to allow of free access of air. The leaves are able to carry on their function of transpiration to a limited extent, one effect of which is to draw on the supplies of moisture in the stems, and so assist in drying. The same functions are brought about with sheaf hay when placed in the stook. Two types of stooks are in general use, viz., the long stook, consisting of two rows of sheaves standing obliquely, and meeting at the top; and the round stook, where the sheaves are arranged in a circle. The former favours quick drying, and is generally used for hay; the latter is sometimes employed when the weather is very hot and dry, causing the hay to dry too quickly. When thoroughly dry, it is carted and stacked either at the homestead or in a

portion of the paddock. On large holdings, it is advisable to stack near some water supply, so that in dry times, when stock may be in low condition, they will not have to travel long distances.

Causes Leading to Deterioration.

Continual wetting after cutting has the effect of causing the more soluble ingredients, such as sugar, dextrin, and an appreciable quantity of the ash ingredients, to be leached and carried away. With such hay, or any, where the natural juices have not been properly dried off, fungi of various kinds will develop. Musty or mouldy hay is decidedly objectionable to stock, while some forms are distinctly harmful.

Another source of waste is due to the crumbling of leaves and the shelling of grain. These constitute some of the most valuable portions of the plants, and care requires to be exercised in order to avoid such losses, both in the time of harvesting and subsequent handlings. For this reason, it is

General View of Land from which Bush Hay was made at Belmont Park.

often advisable to handle the hay during hot, dry weather, in the early morning or late evening, and avoid touching it in the middle of the day. There is a certain amount of dampness in the air at such times, which gives toughness to the leaf and husk, and the losses arising from handling under these conditions, are reduced to a minimum.

The loss of aroma is a point of some importance. While the aromatic matters are probably essential oils—perhaps of no direct value as food—they impart flavour, making the hay palatable, and assisting in digestion. Hay allowed to remain too long in the field, or exposed too much to direct sunshine, will lose a large amount of the aroma, and also its colour.

Besides the loss of aroma, fading of colour, and the comparatively insignificant alterations due to excessive light, considerable losses of food material must necessarily occur whenever hay undergoes fermentation or active chemical change during the process of curing. During the summer months it often happens that it is subjected in the field to one or more wettings before it is placed in the stack. Under such conditions it will be necessary to open out the stooks, or cocks, as soon as the outside surfaces have become dry.

The warmth developed in the field as soon as fermentation begins, and which is really due to chemical action, must not be confounded with the natural heat absorbed during a hot day while drying.

Dryness of Hay when Stored.

To make bright, sweet, and saleable hay it is best to dry no more than is necessary for its preservation in the stack. It keeps best when it is put in such a condition of dryness that upon being trodden it will settle down into a firm, compact mass. In general, when fit for stacking it should not feel damp to the hand, nor should it be by any means brittle, so that it would break easily on being twisted or bent. All hay sweats when it is stacked, and if fed in this condition has a laxative and weakening effect upon animals. This is most pronounced in hay made from immature crops. It is for this reason that many growers prefer to allow their crops to mature fairly well before harvesting. After a few weeks the sweating stage is passed, and the hay may be fed without any danger.

Salting.

The real justification of a practice common in some districts of using salt, or of scattering slacked lime on hay when stacking, is undoubtedly to be found in the power of these substances to check the growth of fungi. They both tend to arrest fermentation and prevent moulding, and the use of them may be commendable in certain cases when partially-cured hay has to be stored in bad weather. Under the average haymaking conditions of Australia their use is unnecessary. In some inland districts, where stock do not obtain all the salt they require, salted hay is preferable to any other.

Brown Hay.

Brown hay is made by stacking it before it is quite dry. In this "fresh" condition there is sufficient moisture to set up a fairly-vigorous fermentation, but not enough for spontaneous combustion. The mass speedily settles, the air is exhausted, fermentation is checked, and the colour changes to a dark-brown. This process is specially suitable for plants having rather harsh, thick stems, as the heat and moisture during fermentation soften the tissues, rendering them more palatable. At the same time, certain chemical changes take place in the food constituents, which render them less valuable for feeding purposes than green hay.

Spontaneous combustion.

It occasionally happens that heavy losses are incurred through firing. This is generally brought about in two ways, (1) stacking before it is properly dried, or (2) through allowing moisture to gain access from any cause. The fermentation set up is caused by the action of micro-organisms in the presence of moisture, and is accompanied by heat, and absorption of oxygen from the air. Where sufficient moisture is present, and the limited circulation of air in the stack does not carry away the heat as fast as produced, the temperature rises. Eventually the heat destroys the organisms, and then direct oxidation

of some substances in the hay commences. Under favourable conditions, the temperature rises till the ignition point is reached, and the mass commences to burn. The greatest amount of heat is generally near the centre of the stack, where the circulation of air is slow and difficult, and it usually takes the form of a smouldering combustion rather than actual flaming. Spontaneous combustion can be readily detected by the smoke, and also smell. It is during damp, or unsettled weather, that the farmer who is anxious to save his hay from damage by rains or heavy dews, is liable to be a little hasty, and run the risk of firing. With properly dried hay there need be very little cause for anxiety, but where stacks are built out in the open care should be taken to see that no rains gain access while building, and afterwards the covering or thatching be such that strong winds will not unroof a portion of the stack. The use of coarse salt will greatly assist in preventing firing, and checking fermentation.

Where there are signs of undue heating, it is necessary to act promptly to prevent trouble and loss. Should it be a stack in the open, excessive weighting will force out the air and prevent combustion. In case a portion of a stack in a shed gets very hot, it will be necessary to cart the damaged portion away as quickly as possible. The use of a ventilation shaft is often recommended, when through unfavourable weather conditions hay has to be stacked before it is thoroughly dry. It allows of a fairly free circulation of air, which carries off any heated vapours, and keeps the temperature normal.

Arrangement of stacks.

Hay stored, particularly in grazing districts, should be protected as far as possible from fire. It is not advisable to place all the hay in one large stack. By having several placed at convenient distances apart, there is always a chance if one catches fire of saving the remainder. In addition, should heavy rains fall while stacking, it is easier to cover a small stack than a large one. An area around the stacks should be fenced in, and either kept bare of grass or in a fallowed condition. It may also be used for growing crops, as well as serving as a firebreak. On some stations, where water is plentiful, the area devoted to the storing of hay may be surrounded by a large open drain which can be kept full of water. This also assists in keeping vermin away, particularly field mice.

Bush hay.

The value of bush, or grass hay, is not universally known, but it is significant that a number of prominent stock breeders utilise the surplus grasses produced in good seasons. As an example of what may be done in this direction, a splendid object lesson is afforded at the well-known estate of Captain Philip Charley, at Belmont Park. Through the courtesy of Mr. W. Charley, the following particulars were obtained :—

As a result of the useful rains during the early part of last autumn, and the phenomenal growth of herbage, it was decided to conduct an experiment in the direction of testing the value of hay made from these native

grasses for feeding to stud-stock. The area devoted to pasture does not lend itself to the economic handling of implements, or the drawing of heavy loads, owing to the undulating nature of the land, which, in places, consists of rather steep slopes, and the belts of timber here and there for shelter and shade purposes. Accordingly, a contract was let in April last for the mowing and raking of 300 acres at 3s. and 1s. per acre, respectively. Cutting commenced on the 3rd of April, four machines being used, and the last of the hay was harvested by the 26th of May. Four two-horse drays were employed in carting; the loading, stacking, and other detail work being carried out by men employed upon the estate. From this area 230 tons were obtained, which runs out at about $15\frac{1}{3}$ cwt. per acre. This was placed in one large stack, and a little coarse salt and brown sugar sprinkled through it. A heavy fall of rain, when the stack was about half-built, necessitated the removal of about 15 inches to be dried, but otherwise there was nothing to interfere with the harvesting operations. The total cost was £218 15s. 8d., which works out at about 19s. per ton. At the present time, Mr. Charley values this hay at £5 per ton. The cost of insurance, £4 per £100, was considered excessive, and as a safeguard against fire an area of 5 acres was fenced in around the stack, and a crop of oats planted. When this is removed it is intended to keep the land in a fallowed condition. After the tops and sides were combed down, wire netting was used on the roof to prevent winds from loosening portions of it. Up to the present 25 tons have been fed. It is chaffed with lucerne, using it in the proportion of one-third to one-half. Mr. Charley is so satisfied with the results that he intends to save further quantities when opportunities offer. A considerable saving has already been effected in purchasing fodder, which, at current rates, would have cost from £7 to £8 per ton. Sufficient has been conserved in a few weeks to tide over any ordinary drought.

Other Products.

In addition to the foregoing, such products as straw, cavings, maize husks, stover, &c., which are too often looked upon as waste, are of inestimable value in times of drought. While they may not be as valuable or as palatable as hay, or silage, still, either by themselves or when used with a little molasses or concentrated foods, they will keep stock alive, and in many instances in good condition. These products are valuable and should be preserved. They need take up but little room on the farm, and should they not be required, may frequently be disposed of to good advantage, and so add to the profits of the farm.

Silos and Silage

The Silo for the Dairy Farmer.

At the last annual re-union of the members of the Camden A. H. and I. Society, Major A. J. Onslow Thompson, President of the Society, read an interesting paper on the tub silo. He said:

I am reading this paper to-night in fulfilment of a promise I made to our committee some time ago when we built our first silo at Camden Park, to the effect that I would give the society the benefit of the experience we should gain, as to the utility and value of this system of conserving fodder, and bearing this in mind, I propose to offer you—not a general address on the subject of ensilage—but rather a few hints on the result of our

Set of four 100-ton Tub Silos at Camden Park.

experience, embodying therein my own opinion, for whatever it may be worth, as to the best and cheapest form of silo, to suit the needs of what may be called the smaller dairy-farmer, together with the details of its construction. It may surprise some of you to know, that it is just thirty-one years since the first silo was made at Camden Park, which was a long narrow pit, unlined, excavated along the brow of a hill, by plough and scoop. This was filled several times with maize, sorghum, and other crops, and excellent silage made, but when emptied, the sides crumbled in, and it had to be lined with slabs at considerable expense; these also in course of time fell in, and it was subsequently discarded and filled up. The same fate befel one made at Menangle a few years later, and from that day until some two years ago, when we built the first pair of wooden tub silos at Cawdor, we made nothing but stack silage, invariably with success, especially in the case of lucerne, the drawback being the great waste that occurred on the sides and ends, whenever the stacks had to be kept for any length of time. We still make them, the pressure being obtained by "Johnson's" drums and ratchets with steel ropes. Having come to the conclusion, however, that it is essential that the storage should be

equally good for five or ten years as one, so that provision can be made in good seasons for bad ones, we decided to build a pair of twin silos of the type of those in use at the Hawkesbury Agricultural College. In response to a cordial invitation from the Principal, as I was unable to get away at the time, Mr. Hindes, of this town, accompanied by our farm overseer, Mr. Leuckel, paid a visit to the College, where they were shown the silos, and all the information possible given to them. It gives me great pleasure to acknowledge the kindness and trouble taken by Mr. Potts and his staff in assisting our representative to find out all he possibly could about the construction, &c., of the silos. Our first pair were built exactly on the same plan as those at the College, but experience has enabled us to make several alterations, which have ensured greater efficiency at a less cost. Before describing the silos which I recommend for a dairy farm, viz., the circular wooden one, I should like to say a word about other kinds of ground silos in use. I admit that I have had personal experience of one kind only, viz., the wooden tub, but I have seen a brick and cement rectangular one, divided into five or six chambers, also circular fibro-cement. The former is far too expensive, apart from other disadvantages, while the latter has three objections: (1) Initial cost, which appears to be greater than the wood; (2) it has not the give and take of wood; (3) it is more difficult to repair, without skilled labour, than a wooden one. The importance of the first and third objections are obvious, while that of the second will be seen later on. I do not pretend to claim that many other forms of silo may not be both economical and efficient, but I consider that owing to its simplicity of construction, probable durability and economy in first cost, the wooden silo should prove the most suitable of all to the small farmer, who, in many cases, will be anxious to do as much of the labour in erecting as possible himself. I have a circular from a firm now, offering to erect a 110-ton fibro-cement silo for about £80, exclusive of the elevator, while, as you will see, a wooden one of similar capacity can be completed, elevator and all, for about £70, or without the elevator for about £60. Taking for granted that it has been decided to build a 100 or 110-ton tub silo—that is, a silo 25 feet high and 16 feet in diameter, the first thing to select is the site. The majority of writers on the subject recommend that the side of a hill be chosen, a shelf, as it were, cut out to receive the silo, so that by drawing the fodder to the upper side, a very short elevator is required. I cannot agree with this, but prefer a level spot, or a slight fall one way, with a good natural drainage from it, as near to the paddocks, where the crops are grown, and the cows are fed, as possible. To begin with, a deep cutting in a hill side is expensive; it is also expensive to draw heavy loads to the top of a hill, and if you have to use an elevator at all, there is little difference in the cost of raising the fodder 25 feet and 10 feet. It is necessary also that there should be good drainage from the site, because, build the silo as faithfully as you will, a good deal of moisture will be forced out of it, owing to the great pressure, and the more easily and quickly this gets away the better. The site having been chosen, I strongly advise that the foundation consists of an octagonal 9-inch brick wall, with sides about 7 feet in length, instead of the cross logs recommended by the Agricultural College. I have tried both, and find the former far cheaper and more quickly built; but where bricks cannot be obtained, a first-rate foundation can be made of logs. On this is placed the sills, which are 9 x 3 hardwood, and on them the circular wall is built of Oregon planks 8 inches x 2 inches and 25 feet long; these are specially cut to fit in the circumference of the 16-foot circle, grooved on both edges, and joined by loose tongues 1½ inch x ½ inch. The Agricultural College uses 2½-inch planks, but I find that 2-inch serves the purpose equally well, and saves 20 per cent. in timber, besides being lighter to handle and erect. The door-frames are 6 x 5 hardwood uprights, 25 feet long with 8-inch x 3½-inch sills, the five doors being made of 8 x 2 Oregon boards 4 feet 6 inches long, three boards to each doorway not jointed, but held in place by the pressure of the silage inside. At the College the doorways are lined inside with felt or some kind of ruberoid, but I find a false door of ½ inch lining cheaper and better, as it can be used over and over again. The wall is held in place by iron bands. The College use seven in number, round iron ⅞ inch diameter, but I find eight are necessary, and prefer flat iron 1½ inch x ⅜ inch rounded at the ends where they enter the door-frames. I also find that the spacing of the bands at the College can be materially altered to great advantage. When the tubs are filled, the pressure of the swelling and heating fodder is so great that it will break these bands, or drag the nuts and washers on the ends into the solid hardwood. To obviate this, I place softwood washers, about 3 inches thick, under the nuts; these are drawn into them, and so any fracture or excessive strain is prevented. These, of course, have to be renewed at each filling. The upright door-frames are held together by iron bolts. There is nothing particular to note about the top plates, roof, &c., which latter is octagonal and a small gable where the elevator enters the silo. The elevator is simply a wooden trough, running from the ground to the top of the silo at an angle of about 40°, 8½ inches wide by 8 inches deep. What are termed "blower elevators" can be purchased attached to the silage cutter, but these are very expensive and require great power to work them; for instance, we work the cutter and elevator at our Menangle silos with a

4-h.-p. steam engine; were it a "blower" instead of an elevator, a 10-h.-p. engine would be required. The fittings, consisting of an endless chain with 8-inch carriers, can be bought from the Link Belt Co., or Lassetters will supply the whole complete. A small wooden chute to discharge the silage from the doors to the floor to bag it or to the dray is also necessery. Having built the silo, I strongly recommend that it be painted outside and tarred inside from top to bottom. The cost of both should not exceed £2 10s. A silage cutter is essential. Those we have at Camden Park we got out from America. They cost under £20 each, and can cut 10 tons per hour, if you can cart it to them. They are No. 16 Ohio. Anthony Hordern & Sons have now taken up the agency; and a very suitable machine for a single silo, a No. 11, can be bought for £11 or £12, which will cut easily 5 or 6 tons per hour, which is far more than a farmer can, as a rule, cart up to it. This brings us to the last item to make the silo complete, viz., the driving or motor-power. Of course the best, where one can afford it, is a steam or oil engine. A 3-h.-p. engine with a 4-h.-p. boiler would work a No. 11 cutter, or a 5½ brake h.-p. oil engine; but I have little doubt myself that a strong 2-horse horse-works would work it satisfactorily. This completes the requirements for building and filling the silo; and I now come to what, to many, is the most important item of all, viz., the cost. I have very carefully calculated this, and estimate that if everything has to be purchased new, and the labour

A Side View of the Tub Silos at Camden Park.

paid for, the whole silo can be erected complete, with elevator and fittings (that is everything except the cutter and engine), for about £70. The foundation should not cost more than £2 10s.; timber, £36; roof iron, £4; the iron bands, &c., £8; elevator fittings, about £8 or £9; painting and tarring, say £3; and labour, £8. The cutter costs about £12, as I said, and a strong horse-works from £20 to £30, while an oil engine, 5½ b.h.-p. costs about £140, or a 3-h.-p. steam engine and 4-h.-p. boiler, from £100 to £130; but for convenience, the oil engine is far superior to the steam.

The question that concerns us to-night is: Is the game worth the candle? In other words, does the result warrant the expenditure? I reply unhesitatingly, Yes, well worth it. If the silo, with cutter and engine complete, costs £100 or £120, in all probability the cost is repaid in the first year. If filled it will contain from 100 to 110 tons of fodder, far more suitable for milch cows than any dry hay or chaff you may buy, the equivalent of which could not be obtained by purchase under £300 or £400. I estimate that from 8s. to 10s. per ton covers every cost in connection with the production of the silage, from ploughing the ground to filling the silos. So taking the highest price for £150, you will have a supply of fodder that would cost you at least as much again to buy, and the silo there to fill again after the contents have been used. I see no reason why, with an occasional coat of tar inside and paint outside, one of these silos should not last fifteen or twenty years, and if one or two planks did prove faulty or decay, they could easily be replaced. In the spring of 1907 we filled at Camden Park six silos. The first was opened

on 3rd August and the last emptied on 16th December ; that is, for nineteen weeks, an average of 800 cattle were fed daily. The total cost of conserving this fodder I estimate to be about £250, and of the six silos £500, that is £750 in all, while, at the then price of fodder, it saved us purchasing to the amount of fully £2,500. This season we were fortunate enough to fill eight silos, and we still have nearly two months' supply left, although we have been feeding upwards of 700 cows daily since 1st July. I mention these facts to show that it is experience, not surmise, that has convinced me that a silo is not only of the greatest value, but really necessary to any dairy-farmer who wishes to combat the unfortunate seasons we have encountered of late. Though the initial cost be large, I am certain of this, it will be repaid a hundredfold, and that in a very few years. It may appear to some that a silo smaller than the one I speak of would answer their purpose and cost less, but I find that a reduction in size, is by no means followed by an equivalent reduction in cost, as if the height be reduced to 20 feet, the roof, plates, sills and foundations remain the same, and the actual saving in cost would not exceed £8 or £10, while the capacity for fodder storage would be reduced fully 20 per cent.

The best Crops to Grow.

A word about the best crops to grow. Undoubtedly, in this particular part of New South Wales, nothing is superior to maize or maize and planters' friend mixed. They are the most easily grown and the most easily cut and carted to the silo, and more rapidly and easily cut by the Ohio cutter than any other form of fodder. The maize should be cut, if possible, just as the grain on the cobs are beginning to turn yellow, and planters' friend just as the seeds begin to form. No pressure is required in the silo other than the trampling of the men who spread the fodder as it is delivered into the silo, the greatest attention being paid to the sides ; if it is evenly distributed, the loss will be nil. Owing to the continual shrinkage of the silage, some time will elapse before it has settled down and the tub remains full ; when this is done, a few inches of dry chaff should be placed on the top, and a few old bags on the top of that. It is quite fit to use in four or five weeks, and will last good for five years ; in fact, if the silo is well built and there are no cracks in the walls, I think one may safely say it will be as good at the end of ten years as at the end of one year. I need hardly state that all classes of cattle eat it readily and thrive on it, including young calves two or three months old. The quantity the silos turn out depends a great deal on the condition of the maize, &c., when it was put in. Three we have emptied this season produced some 1,537 bags each, the bags averaging from 150 lb. to 160 lb. each. I find about 15 lb. per cow a fair feed, when there is a little picking of grass to help. At this rate one silo would feed a herd of forty cows daily for about a year, or, of course, eighty cows for six months. The silage keeps well for two or even three days after having been taken out. If a portion of a silo only be used and no more required, if the surface be left level and covered as when finished, it can be opened again at any time, or refilled without any appreciable loss.

In conclusion, I urge all those dairymen who are able to do so, to build one without delay, and anyone who does so, to build a good one, that is strong enough to withstand the pressure, and of good materials. Do not attempt false economy by reducing the boards or the strength of the iron bands ; such a course will, I am certain, cause trouble in the future. Three coats of paint on the outside, besides improving the appearance and making the silo look as if "someone owned it," are true economy in the preservation of the wood, and do not spoil the inside for a penn'orth of tar.

List of Materials

Required for a wooden silo, 25 feet high x 16 feet diameter, and estimated cost :—

					Estimated Cost. £ s. d.
Foundation :—					
600 bricks, with cement and sand				... about	2 10 0
Timber :—					
Sills ...	8/9′	9 x 3	hardwood	..	,, 36 0 0
Door-frames ...	2/25′	6 x 5	,,	...	
Rafters ...	16/12′	3 x 2	,,	...	
Battens ..	50′ super.	3 x 1	,,	...	
Fillets ...	8/8′	3 x 1	,,	...	
Wall planks ...	78/25′	8 x 2	Oregon grooved		
Wall tongues ...	80/25′	$1\frac{1}{8}$ x $\frac{1}{2}$	Oregon	...	
Plates (top) ...	8/9′	4 x $2\frac{1}{2}$	,,	...	
Doors ...	5/13′	8 x 2	,,	...	
Door sills ...	5/3′	9 x 4	,,	...	
Elevator planks	6/17′	9 x $1\frac{1}{4}$	,,	...	
Delivery shoot	12/10′	6 x $\frac{1}{2}$	,,	...	

		£	s.	d.
Roof:—				
Galvanized iron 16/6′ sheets	about	4	0	0
Guttering, &c., 12 lengths 4″ half round ...				
Ironwork:—				
8 bands $1\frac{1}{2}$″ x $\frac{3}{4}$″, complete, about 50′ long ...	,,	8	0	0
5 bolts $\frac{3}{4}$″ round iron, 3′ 2″ long, and washers...				
Elevator Fittings:—				
One coupling link	,,	9	0	0
2 No. 57 x $7\frac{1}{2}$″ sprocket wheels bored for $1\frac{1}{2}$″ shafting...				
4 $1\frac{1}{2}$″ light plumber blocks and 4 $1\frac{1}{2}$″ collars ...				
2 lengths of 1/14″ and 1/22″ steel shafting ...				
250 ordinary links, No. 57				
62 8 x 2 x 1 x $\frac{1}{16}$ carriers				
62 No. 57 KI attach links				
Painting and tarring	,,	3	0	0
Labour in erecting, &c.	,,	8	0	0
No. 11 Ohio silage cutter	,,	12	0	0
Miscellaneous items—say	,,	1	10	0
Total (exclusive of motive power) ...		£84	0	0

A McCormick Harvester cutting Corn for Silage.

Ariah Park.

MR. F. W. DAVEY, of Felix, Ariah Park, some two years ago erected a tub silo of tongued and grooved Oregon, 25 feet high by 16 feet in diameter,

having a capacity of 100 tons, and built entirely in accordance with specifications drawn out by the Department. This silo he filled immediately with wheat; but, not having had previous experience, the silage did not prove satisfactory. Last year no crop was available to put into the silo, and this year, with a view to ensuring success, the Chief Inspector visited, in order to give advice respecting future operations. The conclusion was arrived at that the real cause of the failure referred to was that the crop was put into the silo when far too ripe and dry; besides which it was found that through the chaff-cutter (an ordinary one—not a silage cutter) breaking down, the silo had been filled only one-third with chaffed fodder, the remainder having been put in in the sheaf. This was a very unsatisfactory method of filling; and, through the fodder being too dry, the material did not ferment properly, and much of it turned mouldy. On the occasion of the visit of the Chief Inspector, the fodder was found to be decidedly on the dry side. It was, therefore, moistened as it was chaffed into the silo, by means of spraying, with the aid of a pump on a (fire-fighter) water-cart. Mr. Davey was advised, when the filling is completed, to cover the top of the silage with chaffed straw to the depth of a few inches, and to thoroughly soak this with water, putting in about 2 gallons to each square foot of surface, and then to put weight on it.

A difficulty Mr. Davey experienced was that, in filling, the spreading was was not being done evenly, as the heavy portion of the chaffed fodder was falling in the centre, and the lighter flag, &c., on the outside. Upon the advice of the Inspector a bag chute was constructed, by ripping open the bottom of chaff-bags and sewing them together, and affixing them to the top of the elevator. This device acted excellently, and with it one man was able to do the spreading as well as the tramping down, whereas spreading with forks necessitated having two men in the silo.

Mr. Davey's experiments in conserving wheat in the form of silage is being watched with interest by farmers in the district, as they often have crops which would be unsuitable to cut for either grain or hay, but which would make excellent silage; such as, for instance, wheat or oats which have come up thinly, and are full of barley grass, trefoil, thistles, &c.

Mount Horeb.

Acting upon the advice of the Departmental officers, Messrs. Kershaw and Davies, of Mount Horeb, decided to build three silos, each having a capacity of about 350 tons. After carefully examining the plans and specifications of various types which were submitted to them by the Department, a selection was made of the tub silo, somewhat of the type used at the Hawkesbury Agricultural College. The silos are built of 3 in. x 2 in. Oregon, the size of each being 35 feet high by 25 feet in diameter.

The Chief Inspector recently visited Mount Horeb, when he found that Messrs. Kershaw and Davies had completed one of the silos, and were erecting a second one. They had under crop 500 to 600 acres of oats, barley, and wheat, which they were growing for silage and hay, with the idea of clearing

the land preparatory to sowing lucerne. Upon the occasion of the Chief Inspector's visit it was found that the first silo was being filled with green barley, a powerful Ohio silage-cutter, with blower attached, being used for the purpose of filling.

Messrs. Kershaw and Davies' greatest difficulty was to know the proper time when to cut the crop, as, upon consulting the farmers in the neighbourhood, quite a variety of answers were received; and, further, some few farmers advised them to allow the sheaves to stand in the field to wilt for at least twenty-four hours. Upon examining the standing barley crop, the Chief Inspector concluded that, if anything, it was a little on the ripe side; and he advised that it should be cut at once, and put into the silo as rapidly as it possibly could with safety. In all cases with hollow-stemmed forage crops, such as wheat and barley, it is necessary to cut slightly on the green side, and usually the crop is ready for putting into the silo as soon as it is fully flowered. In a moist season, of course, it could be left to a later stage of ripeness.

As the crop of barley after cutting was sufficient to fill only half a silo, Messrs. Kershaw and Davies were advised to fill up with a crop of oats which came up thinly, and which was smothered with barley grass, trefoil, and thistles. This crop is almost valueless for either grain or hay, but was considered to make splendid silage. They were also advised to utilise in the same way the thistles and barley grass, which were growing thickly along the roads and headlands.

This experiment of conserving fodder on a large scale, for feeding sheep and other farm animals, is being watched with very great interest in the neighbourhood.

The Manurial Value of Wood Ashes.

A sample of the ash from the fuel (box) used under the boilers of the pumping plant of the Wentworth Irrigation Area was recently submitted to the Departmental Chemist for analysis, with the following result:—

Unburnt carbon (insoluble matter)	11·12	per cent.
Lime...	50·78	,,
Phosphoric acid	0·58	,,
= Tricalcic phosphate	1·27	,,
Potash	3·31	,,
= Sulphate of potash	6·31	,,

The ash has, therefore, a manurial value of at least 18s. 9d. per ton without the lime, for which fruitgrowers in the county of Cumberland would gladly give 20s. a ton on their orchards. The lessees of the Wentworth Irrigation Area will find this ash to be a beneficial fertiliser for their fruit-trees.

Useful Australian Plants.

J. H. MAIDEN,
Government Botanist and Director, Botanic Gardens, Sydney.

No. 100. *Sporobolus virginicus*, Kunth.

Botanical Name.—*Sporobolus*, already explained (see this *Gazette*, December, 1908); *virginicus*, a Latinised word; Virginian, from the American locality whence the grass was first described.

Vernacular Name.—"Seaside Rush Grass" of Lamson-Scribner, a well-known American authority.

Where figured.—Labillardière, Pl. Nov. Holl., i, 20, t. 33, as *Agrostis virginica*; Trinius as *Vilfa virginica*, Spec. Gram., t. 48.

Botanical description (B.Fl., vii, 621).—

> *Stems* much branched and leafy at the base, erect or decumbent, 6 to 10 inches, or rarely 1 foot high.
>
> *Leaves* short and narrow, often very spreading, convolute when dry, rather rigid, glabrous or ciliate at the base.
>
> *Panicle* rather dense, narrow and spikelike, or rather more branched at the base, 1 to 1½ inches long, often rather dark-coloured.
>
> *Glumes* keeled, rather acute, about 1 line long, the two outer and flowering one similar, or the lowest rather smaller.
>
> *Palea* rather longer, the two nerves close together so as to represent a broad keel, but very readily splitting, showing an inflexed margin between the nerves.
>
> *Grain* broadly obovoid, the very thin pericarp separable when soaked, but undistinguishable in the dried state.

Bailey (*Botany Bulletin*, No. xiii, p. 15, April, 1896) describes a var. *minor* in the following words:—

> *S. virginicus, var. minor*, Bail., which is found in similar situations, but often further from the coast. Both have dark-green foliage and more or less elongated stems by which the plants spread. The spike-like inflorescence is usually of a somewhat dark colour. Neither of these grasses (*i.e.*, this form and the normal one) will thrive far from brackish water; but in such localities they form excellent fattening pasture.

Value as a fodder.—This grass has something of the habit of Couch-grass (*Cynodon*), and is particularly valuable for saline situations. It is somewhat hard, but cattle become readily accustomed to it, and it is a nutritious grass, though not of the first class—at all events, in New South Wales.

In Jamaica, horses become rapidly and astonishingly fat while feeding upon this grass.—(Jenman.)

Habitat and Range.—The original describer quoted it from Virginia, Jamaica, Martinique, Peru, the Sandwich Islands, Mexico, Cape of Good Hope, and New Holland.

Speaking of the United States, Lamson-Scribner gives its range "Sandy shores, Virginia to Florida, westward to Texas" (also, Mexico and West Indies).

Like many coastal species it has an extensive range. It occurs also in Asia and in non-Australian countries other than those enumerated.

As regards Australia, the "Flora Australiensis" enumerates it from :—

Queensland.—Port Curtis, *McGillivray.*

New South Wales.—Near salt marshes, *Woolls*; beach near Bulli, *Johnson.*

Victoria.—Port Phillip, *R. Brown*; along the coast from the Glenelg to Snowy River, *Robertson*, *F. Mueller*, and others.

South Australia.—Port Lincoln, *R. Brown;* round Spencer's and St. Vincent's Gulfs, *F. Mueller* and others; Fowler's Bay, *Richards.*

Western Australia.—From King George's Sound, *R. Brown* and others, and Esperance Bay, *Dempster*, to Swan and Murchison Rivers, *Drummond*, n. 143, 372, *Preiss*, n. 1841, *Oldfield* and others; Sharks' Bay, *Milne.*

As regards the range in Queensland, Bailey has the note which, although in the main a repetition of what has been already stated, is quoted at length for completeness' sake.

S. virginicus proper is the stout-stemmed erect grass, with erecto-patent rather harsh leaves, found on the brackish, marshy lands near the coast.

Var. *minor*, Bail., is found in similar situations, but often further from the coast. Both have dark-green foliage, and more or less running underground stems. The spike-like inflorescence is usually of a somewhat dark colour. Neither of these grasses will thrive far from brackish water, but in such localities they form excellent fattening pasture."—("Queensland Flora," p. 1880.)

Turning to Victoria, according to Mueller it occurs in all the botanical divisions of that State enumerated by him.

Tate records it from all divisions of South Australia, except his F (extreme north), W (west of Lake Torrens), N (northern agricultural areas), and T (90-mile Desert and the Tattiara).

We have it also from the "north-east coast," also from Perth, W.A., Lake Eyre (Baldwin Spencer), and Cootanoorina, W.A. (R. Helms, Elder Expedition).

In New South Wales it is represented in the National Herbarium, Sydney, from the Sydney district, *e.g.*, Homebush, between Parramatta-road and Homebush Bay, Como (George's River), and Lane Cove.

Also from Menindie Lake (River Darling), where it is known as "Menindie Grass." In all cases it is in brackish and even saline localities, and it is one of the species found both in the coast and saline interior districts, both in New South Wales and the other States.

Ideas as to the range of this species depend on the view that individual botanists take as to whether var. *pallida* is a distinct species (*S. Benthami*, Bailey) or not. I will refer to this in dealing with *S. Benthami* (the next grass).

EXPLANATION OF PLATE.

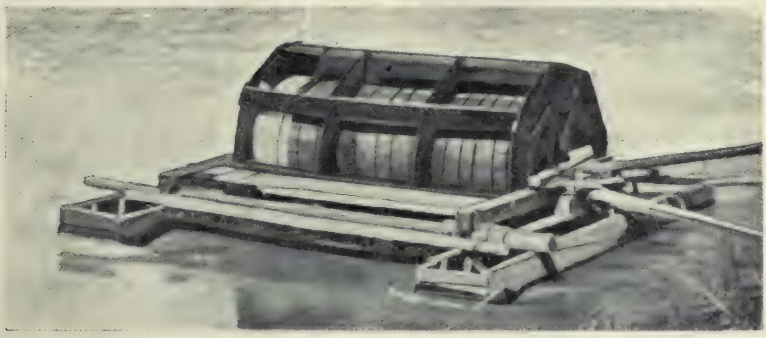
1. Entire plant, natural size.
2. Branch of the panicle, much enlarged.
3. A single spikelet.
   a. Outer glume.
   b. Second glume.
   c. Flowering glume.
   d. Palea, split in two.
   e. Grain enclosed in the pericarp.
   f. Grain, the pericarp removed.

SPOROBOLUS VIRGINICUS, KUNTH.

AWN FOR THE "AGRICULTURAL GAZETTE," N. S. WALES.

A Current Pump for Irrigation

VARIOUS devices have been contrived to induce the current of a stream to deliver a part of its water at a point above from which it can flow by gravity to the land on which it is to be used. A new device, patented by Robinson and Gaylor of Thermopolis, Wyoming, floats in the Big Horn River at Thermopolis, and has for several weeks thrown a 6-inch stream of water to the top of the river bank 22 feet high. The stream will irrigate a 160-acre farm. If land lay higher this machine could irrigate it, as its capacity is a 6-inch stream 52 feet high. Machines of different sizes may be made, depending on the volume of water desired and the height of the banks.



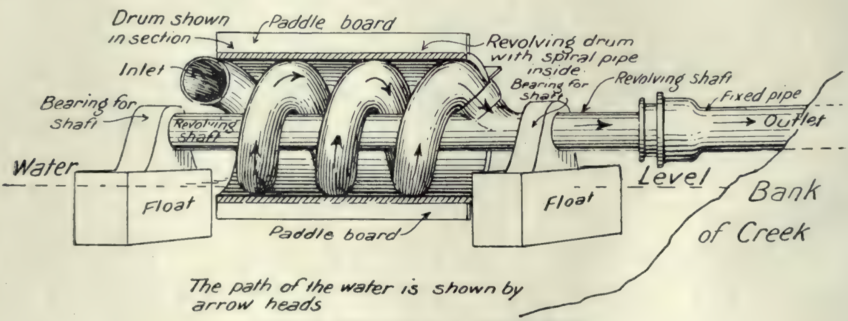
A Current Pump for Irrigation.

The one in use consists of a wheel or drum 16 feet long and 6½ feet in diameter, made to revolve on a metal axis. To the outer surface are fastened longitudinal paddles, making a total diameter of 10 feet. The whole is supported and floated on a pontoon contrivance, the paddles catching the current of the river and supplying power on the simple principle of an undershot waterwheel.

The centre around the axis is simply a hollow core and has no part in the work of the lift. Between this core and the outer surface of the drum is a spiral water channel extending longitudinally thereof. This channel has an open mouth or intake at one end extending slightly beyond the outer diameter of the drum, and so arranged that it faces in the direction of rotation and will dip a given quantity of water at each revolution of the wheel. At the opposite end of the spiral channel is an outlet consisting of a pipe which is connected to and discharges through the axis at one end, which is made hollow for the purpose. Attached to this by a swivelled arrangement is a 6-inch discharge pipe, the outer end of which is elevated to the height to which it is desired to raise the water. The intake, being submerged only a portion of the time, takes in only a prescribed quantity of water. As the wheel revolves this water seeks the lowest part of the spiral channel, and is followed

in turn by a given amount of air until the intake is again submerged. Thus the process is repeated, the spiral channel being filled with successive quantities of water and air. As it advances in the channel and the resistance becomes greater the air becomes more compressed, the channel being so arranged as to maintain the proper proportion of water and air through its entire length. The revolution of the spiral channel and the consequent compression of the air causes the water to be discharged with great force through the outlet by what might be called pneumatic hydraulic pressure.

Aside from the main wheel itself, which revolves in a rigid framework, there is no movable part to get out of repair, and not a valve to become worn and leaky. The one in operation at Mr. Gaylor's ranch—which, by the way, is the first one ever built—was seen by a representative of this paper a couple of days ago. Two weeks had passed since it was put in, and it had never stopped five minutes in that time. It was raising 75 gallons per revolution to a height of 25 feet, and seemed to have immense reserve power. The water being raised would irrigate more than 100 acres of land, and it was not running anywhere near its capacity. Its usefulness may be shown by the statement that not a foot of the land could ever be brought under a gravity ditch.—*Pacific Rural Press.*



Internal Arrangement of Current Pump.

In order to make the matter more clear, the above sketch has been prepared by the Public Works Department showing the arrangement of the pump so far as can be gathered from the printed description. The idea is described as an ingenious one, and the opinion is expressed that the plant would be of service in streams in which there is a good flow of water. It should, however, be noted that details of the spiral channel are not given. The cost of the apparatus need not necessarily be high, as the spiral pipe and hollow shaft could very easily be made of galvanised iron with sweated joints, the remaining parts, other than the delivery pipe, being made of timber.

In the western part of the United States current wheels are widely used for lifting water for irrigation purposes, and are often the cheapest means of raising small volumes of water to low heights where much larger volumes are flowing by them. A wheel can, of course, lift only a small percentage of water passing it; but in this State there are few streams where the current is continuous and the flow sufficient to make such a device of practical value, although in some positions on our large rivers a current pump might be found suitable.

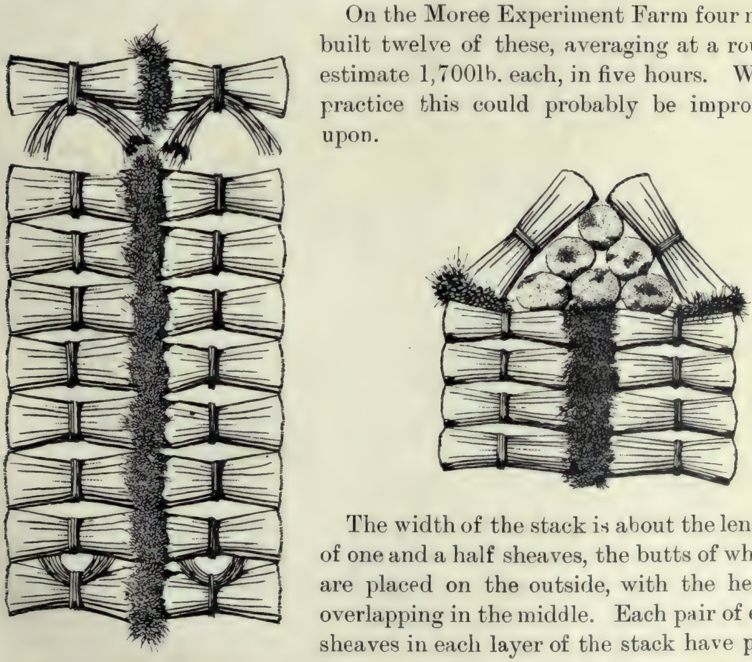
Hoopjes.

A South African Method.

A. E. DARVALL,
Manager, Moree Experiment Farm.

These are small stacks containing about 150 to 200 sheaves, that the South African farmer builds in the fields, and in which he lets his hay sweat for about ten days before hauling it to the big stack. The great advantage of these is, that once the hay is in them, it is practically safe from rain; it cannot dry out too much, as it would if left in stooks for any length of time, and the butts only being on the outside, the birds cannot get at any grain that there may be in it; moreover, having sweated in these small stacks, it is perfectly safe to put into big ones, there being no chance of heating.

On the Moree Experiment Farm four men built twelve of these, averaging at a rough estimate 1,700lb. each, in five hours. With practice this could probably be improved upon.



Plan and elevation of Hoopjes.

The width of the stack is about the length of one and a half sheaves, the butts of which are placed on the outside, with the heads overlapping in the middle. Each pair of end sheaves in each layer of the stack have part of their heads and butts bent at right angles towards the centre of the stack; the next sheaves resting on these ends bend them in so that they cannot be forced out by the weight of those above them. When the stacks are some five or six layers high, they are topped off by laying a row of three sheaves abreast along the stack, crossing the sheaves below. On these a layer of two abreast are

laid in the same direction, and finally one along the top. The stack is then thatched by laying sheaves with their butts meeting at the ridge, and their heads coming down to the eaves, the end sheaves of this thatch having a portion of them bent at right angles to bind them in, as in the main body of the stack.

These stacks should be built on a slight rise in the ground—never in a hollow; otherwise water will find its way underneath, should it rain heavily.

The illustrations should really show the sheaves overlapping more in the plan, and the two thatching sheaves meeting at the ridge of the elevation.

Shell for Fertilising Purposes.

The attention of the Department has been drawn to the existence at the Pambula River of a quantity of shell which may be of value as a fertiliser in certain cases. A sample was recently submitted to the Chemist for analysis, with the following result:—

	Partially decomposed shell.	Whole shell.
Lime (CaO)	44·59 per cent.	44·44 per cent.
Equal to carbonate of lime...	79·62 ,,	79·36 ,,
Phosphoric acid (P_2O_5) ...	·10 ,,	·10 ,,

The analysis indicates that the material is rich in lime, and if ground would be a good application for sour soils or soils deficient in lime, and would also be of value in lightening stiff clay soils.

If burnt before being ground, it would be more effective; but the question as to whether it would pay to burn it would have to be taken into consideration, and would depend upon local conditions—whether timber is plentiful, &c.

Its most useful application would be that first mentioned, *i.e.*, the amelioration of sour soils; but before being used for this purpose, it must be ground.

It is reported that there are some thousand of tons of this shell close to the river.

Rearing Calves.

H. R. ALEXANDER.

Rearing and feeding calves should be one of the most important duties on the dairy farm. From the calves of to-day we look for the cows of the future, and unless these calves are well fed and cared for, we cannot expect them to develop into prime dairy stock. Dairy calves or heifers, to be a success as cows, must be kept growing and doing well, without unduly fattening, right from birth till they come into profit as milkers. Any check in growth or derangement of the digestive organs will have a deteriorating effect on the after value of the stock. On the other hand, a tendency to fatten, once developed in the heifer, will in all probability continue in the cow, and at the expense of her milk production.

Calf-rearing is a simple and interesting occupation. Success will be assured when the feeder combines a good temper with a knowledge of cleanliness and a fair amount of common sense. On the question when the calf should be taken from the cow, opinions differ among dairymen. Some allow the calf to remain with the mother for several days after birth, and claim by so doing that the calf receives a better start in life. Other farmers hand-feed from birth. Under the first system the calf is long enough with the mother for the cow to become attached to her offspring; it is not desirable to develop this maternal instinct to any great extent in the milker, as when the calf has ultimately to be taken from her the cow frets, her milk yield being correspondingly checked. Further, having become accustomed to drawing its own supply of provender, the calf often objects to drinking from a bucket for several days, thereby receiving a considerable set-back. At Wollongbar the calf is left with the mother for twenty-four hours after birth. During this time the cow will have cleaned, fed, and established the youngster on its legs. Under this system, should the cow fret when the calf is removed, no shrinkage in milk-flow will be apparent; and at this particular period of the cow's lactation milk is of no value from a cheese or butter-making point of view; in fact, colostrum has a most injurious effect on all dairy products. This being so, should a shrinkage be noticeable no real loss will be sustained. Nature has provided this first milk, known as "colostrum," or "beastings," as the first natural food of the calf. Colostrum has a cleansing and laxative effect on the stomach and bowels; it regulates and stimulates the whole digestive tract into healthy action. No medicine or prepared food can take the place of colostrum, and no calf can be successfully started in life without receiving its just share of "beastings."

When taken from the cow, place the calf in a clean, comfortable pen, with a small run attached. All calves under 4 weeks old should be kept in this paddock, to allow of their being thoroughly established on a skim-milk diet before being drafted out among the bigger and stronger calves. To

make calves tractable and easily handled in after life, a good plan is to tie up all youngsters for a few hours daily in this small yard; the lesson will never be forgotten.

During the first week or ten days of a calf's life, feed the youngster three times a day on the warm, unadulterated mother's milk. By feeding three times daily there is less risk of overloading the stomach, thereby taxing the strength of the calf's digestive organs, than if the calf is fed only twice, in the morning and evening. At the expiration of ten days the mid-day meal can be dropped. Once the calf becomes accustomed to two meals per day, a small quantity of skim-milk may be added to the food, also an ounce of lime-water. Lime-water strengthens the system; also tends to neutralise acidity of the stomach, thereby to a degree preventing scours.

Gradually increase the percentage of skim-milk; at the same time reduce the quantity of full milk till the calf is 4 weeks old, when it should be fed solely on a skim-milk or whey ration. As the calf's diet is undergoing change, a 2 or 3-ounce dose of castor or raw linseed oil, given twice a week in the food, has an excellent corrective effect, and prevents costiveness, the sure sign of digestive troubles and a forerunner of scours. Up to this stage no food other than milk is advisable, the change from full to skim-milk being a severe enough tax on the calf's strength without any addition of solid matter in the ration. After the four-weeks' stage, some calf-food can be fed with advantage; gradually add the food to the milk, taking, say, two weeks to place the calf on a full allowance.

A mixture of crushed linseed 1 part and pollard 2 parts, when well boiled, makes a cheap and nutritious food, and compensates to a degree for the butter-fat extracted.

A full one-meal allowance for a 6 weeks old calf would be—

1 pint linseed and pollard porridge,
1 oz. lime-water,
10 lb. skim-milk.

This to be increased as the calf grows older. Should milk be short in quantity, the addition of porridge and water to the above ration would keep the calf growing.

As milk passes through a separator it becomes considerably charged with air. The presence of any excess of air in skim-milk is harmful if fed to calves, and will cause colic and scours. Separated milk should be allowed to stand for a short time, prior to feeding to poddies, to permit of air escaping. Splendid results follow cooling skim-milk as it comes from the separator, afterwards warming the cooled milk to feeding temperature by means of steam or a hot iron. If calves must be fed on skim-milk direct from the separator avoid all froth. Allow calves free access to rock salt.

When cheese is made, follow above feeding rules, substituting whey for skim-milk and allowing a larger quantity of linseed porridge.

To make the whey more palatable, also to increase the feeding value, 2 ounces of molasses per meal may be added to ration. This quantity of molasses will be found ample; if fed in excess molasses has a rather opening effect on the bowels. As drawn from cheese vat whey contains a varying

amount of gas, which, if fed direct to calves, would in many cases cause hoven. Whey should be allowed to stand for an hour or two to allow of gas escaping, or better still whey could be pasteurised and cooled as drawn; this would expel all gas and check development of acidity. Calves can be reared equally as well on whey as on skim-milk provided cleanliness and care be observed.

Suppliers to co-operative factories should insist on all whey shoots and tanks being kept in a sweet condition; they must be scrubbed and scalded daily.

Feed calves regularly, their meals as nearly as possible dividing the twenty four hours. Their food must be warm, fresh, clean, and fed from thoroughly clean buckets. All calf food should be so pure and wholesome that the feeder would, if need be, drink of the mixture. Feeding temperature should be maintained between 90 deg. and 100 deg. Fahr.

Three feeding systems are in vogue among dairy farmers—from troughs, by means of rubber teats, and by bailing up and feeding from buckets. Having tried all these methods I can unhesitatingly recommend the last mentioned. Diminutive bails can be erected at a very small cost, and by feeding each calf individually from buckets every animal receives its proper allowance of food, and sickness or loss of appetite can readily be detected and attended to.

When feeding from troughs the method is to fill the trough with milk for, say, twelve calves; after drafting this number of poddies into the feeding yard the feeder takes his stand at one end of the trough armed with a long stick. As the greedy, quick drinking calves appear to have had enough, the feeder, gently or otherwise, as the case demands, taps them on the nose with the stick, keeping them back in this way till the weaker or slower drinking calves get their share. Needless to say, calves fed in this way never look an evenly nourished lot. Feeding by means of teats may have some good points, but experience has proved to the writer that results never compensated for the trouble and expense connected with the rubbers and tubes.

If grass is plentiful calves need no other food in addition to ration already mentioned. During dry summer spells and winter months an allowance of hay or silage is necessary. To ultimately become a cow with the depth of body and capacity for food so desired in milkers, the digestive organs of the calf or heifer must be fully developed; this can only be done by liberal and bulky feeding. Silage made from any green fodder makes an ideal roughage for young dairy stock; it is cheap, palatable, easily digested and readily eaten; silage acts as a laxative and keeps the bowels in a healthy condition; lucerne, meadow and Hungarian millet hays are excellent fodders, but are considerably more expensive than silage. Oaten or wheaten hay when fed to young stock is digested and relished better if chaffed and damped down with molasses and water.

When feeding hay from racks, should calves appear somewhat costive, 2 or 3 ounces of crude molasses given in their milk will correct the trouble.

When weaning, put calf on one meal a day for a week or two and then feed once every other day, gradually reducing food allowance till calf is weaned.

When to wean depends on the calf and grass available; it never pays to wean a calf and turn it out to starve on bare paddocks.

Artificial Incubation.

Carbonic-acid Gas in Incubators.

THE great percentage of loss of chickens when hatched by artificial incubation has recently been engaging the attention of the poultry experts of the Commonwealth. The experience in this State is that there is a loss of 25 per cent. by the use of the best incubators, and with ducks the loss has reached as high as 50 per cent. The Tasmanian Government Poultry Expert (Mr. R. J. Terry), who has been studying the question of incubation for some years, has contributed a series of articles to the *Agricultural Gazette* of Tasmania, in which he expressed the opinion that the bulk of incubators are not constructed on quite the right lines to get the best results. He considers that there is far too free a circulation of air in them, and instances natural incubation, which is not the domestic hen possibly set on eggs in a nest shaped and constructed of materials that we consider right, but rather the wild birds as they would incubate their eggs. Impure air, as is generally known, contains a large amount of carbonic-acid gas, or what is scientifically termed carbon dioxide. At first sight, especially to the lay mind, it might be thought that this would have a bad effect on the growing chick. The reason for arguing in this manner is, that human beings and animals who breathe through the lungs aerate or purify the blood through its contact with the air ; the more oxygen that air contains the better the condition of the blood, which means the health of the human being or animal. But it should be borne in mind that the embryo that is contained in the shell of the egg during its development is not breathing through its lungs. In animals which bring forth their young alive, it is found that the embryonic blood is charged with carbon dioxide. The amount contained in the fœtal blood would be found to be in great excess to that in the ordinary blood in the adult animal, which would tend to decrease the circulation of the blood in the fœtus. Owing to the slow circulation through the placenta, the fœtus is, practically, what may be described as half-suffocated. Now, why should not the same laws be at work in a natural or artificial incubation, although the development takes place outside the hen's body? It will be shown later on that the eggs are surrounded by a large amount of carbon dioxide, that is, if the eggs are hatched in a natural manner by a hen. The point to be impressed is this : That carbon dioxide would have the effect of decreasing circulation of the blood, rendering the action of the heart slower.

The writer goes on to say that carbon dioxide is found in large quantities under the hen, and, as a result of repeated experiments, it has been learnt that the quantity under the hen is three times greater than that in the incubator, although the latter contains a much larger number of eggs. Besides

affecting the development of the embryo, it is a great factor in another direction to the successful hatching of chicks. This carbon dioxide, in conjunction with moisture, has the effect of decomposing, or rotting, as it might be more familiarly termed, the shell of the egg, thus rendering it an easy matter for a fully-developed chick to break out. During his experiments, and also when visiting farmers who had unsuccessful hatches, Mr. Terry was impressed with the large number of fully-developed chicks dead in the shell, and it was some time before he got the idea of the over-ventilation. The thought once started, he used to investigate on the data given him by the operators. This led to further experiments by himself, and he is now convinced that the bulk of the chickens that are found dead in the shell die simply from exhaustion. Out of the large numbers he has examined, in nearly all cases they showed that the birds had been striking at the shell; while in several instances their vigour and sustained effort had resulted in extravasated blood around the head, especially base of beak and upper portion of the neck. This was most noticeable in those incubators which did not contain any water supply ; but in one of the same machines, containing the same class of eggs, but worked in a cellar, the result was altogether different, there being, practically, no dead in the shell. The atmosphere in the cellar was very bad indeed, and if the burning of the lamp is taken into consideration, the atmosphere must have been far from ideal for adults inhaling air through the lungs, and this alone was thought very strong evidence that the embryo does not require the same air as the adult. Further, it is the custom in those countries, such as America, which have given some attention to modern incubation, to build the incubator houses partly sunk in the ground. These houses would have a tendency to retain carbonic-acid gas, but we have to go a step further and consider whether the carbonic-acid gas is emitted from the hen's body, from the eggs, or from both. Mr. Terry was inclined to think from both. Experiments carried out in a rubber nest, with a hen sitting on china eggs, showed the amount of carbonic-acid gas contained in the air to be, practically, the same quantity as that in a similar nest in which eggs were undergoing incubation. It has also been found that, contrary to what one would suppose, the amount of carbonic-acid gas does not, apparently, increase with the development of the embryo. It may be thought that great stress has been laid on this matter—carbon dioxide—in its relation to artificial incubation, but Mr. Terry considered that there was a big field for research.

To Mr. Terry, it seems, that in future we shall have to introduce carbon dioxide into the incubators in some form—just what form it should take and what quantities he is not prepared just yet to state. There seems to be good effects brought about by a more or less saturated atmosphere in the incubators when brought in conjunction with carbonic-acid gas. Experiments, so far, have gone to show that the chicks hatched from those machines in which the fresh air first passes through a damp cloth, or the machines which contain damp sand, are larger and more vigorous than those from dry machines; but it may be that the increased moisture has the effect of

improving the development of the fluff, although when a number of chicks were weighed from the wet incubators they were found to be heavier than those from the dry. This could be easily accounted for by absorption, as we all know that a large portion of the bodies of either animals or birds is composed of water. The advice is tendered that much ventilation should not be given to the eggs till after the sixth day; to have water or moisture supplied in some form during dry weather until within about three days of hatching. Do not place the incubator in a dry, sunny, draughty room; a cellar is considered to be an ideal position. Even with those machines which are said not to require moisture, it is advised that a damp (not a wet) sponge or cloth to be placed on the bottom of the machine during dry days.

Other causes of failure in artificial incubation are dealt with, and with a view to initiating experiments to be conducted on a scientific basis, the Department of Agriculture of this State invites discussion on the subject, so that the experiences of local poultry-breeders, and their opinions, may be ascertained and further research carried out.

Thrips on Wheat.

The Government Entomologist recently visited Dubbo to investigate a case which has been brought under the notice of the Department of wheat infested with—what eventually proved to be—thrips. This is the first record Mr. Froggatt has had of thrips being found in wheat in Australia, although it is known to do serious damage to wheat in Europe. On visiting the paddocks, Mr. Froggatt found any green wheat therein to be swarming with a small black thrips, apparently of a new and indigenous species. The farmers consider that it has caused a considerable amount of damage to the ripening wheat, and that the terminal grains on the tip of the ear are aborted by them. If this is the case, even a single grain of wheat out of every ear would mean a considerable loss in a field of wheat. It is, unfortunately, too late in the season to ascertain the actual damage, but the matter will be investigated very fully next season with a view to preventive measures being recommended.

River Bank Erosion.

A Useful Australian Grass, *Phragmites communis.*

Messrs. Samuel Vaile and Sons, of Auckland, New Zealand, write, enclosing a cutting from a local paper, referring to a reed native to New South Wales, *Phragmites communis*, Trin., which has been recommended as a protection to river banks.

The extract in question is quoted from the published experience of Mr. Fred. Turner, F.L.S., of this State, and the writer asks that further information be obtained, more especially with regard to certain specific questions—(1) as to any danger of the reed spreading into drains, shallow creeks, and swamps emptying into the rivers whose banks may be protected by this reed, and (2) as to the greatest depth of water in which it will grow.

As a matter of professional courtesy, the writer was referred to Mr. T. F. Cheeseman, Curator of the Museum in Auckland, a botanical authority of eminence in the Dominion, who would be able to give the advice sought, but as the questions are of importance to many persons in New South Wales who have to consider the problem of protecting the banks of the rivers and creeks on their boundaries, we reproduce a few additional notes supplied by the original author of the contribution that elicited these questions, which will be as interesting to them as to our correspondent in New Zealand.

Description of the Plant.

The "common reed" (*Phragmites communis*, Trin.) is a stout perennial grass with extensively creeping underground stems. It grows from 5–12 feet high or more, and has numerous long leaves, often more than 1 inch broad in the middle, the sheaths of which cover the stems as far as the inflorescence. The panicle is from 5–18 inches long, and consists of numerous, drooping branches of spikelets, which are often of a purplish-brown tinge. The long silky, beautiful, silvery hairs on the fully developed inflorescence give the grass a decidedly ornamental appearance. Etymology: *Phragmites* is from the Greek for enclosure; the ancients used the stems for fencing; *communis* means common. At one time the aborigines made their baskets from the stems of the "common reed," and also their light spear-handles.

The "common reed," when dry, yields 4.7 per cent. of ash, which, according to Schulz-Fleeth (Watts, Dic., I., 413), contains in 100 parts—

Potash (anhydrous) ...	8·6	per cent.
Lime ...	5·9	,,
Magnesia ...	1·2	,,
Ferric oxide ...	0·2	,,
Sulphuric acid (anhydride) ...	2·8	,,
Silica ...	71·5	,,
Carbonic acid ...	6·6	,,
Phosphoric acid (P_2O_5) ...	2·0	,,
Sodium chloride (common salt) ...	0·4	,,

Incidentally it may be pointed out that this grass would have a distinct value as a mulching for fruit-trees, strawberries, and vegetables. The manurial value of the ashes, according to this analysis, is 57s. 6d. per ton.

Question 1: Would there be any danger of the "reed" spreading into drains, shallow creeks, and swamps emptying into such rivers?

Answer: The plant would spread in open, shallow, moist drains when it became established on the sides, but not far enough from the margins of creeks and swamps containing permanent running water to impede its flow.

Question 2: What is the greatest depth of water in which it will grow?

Answer: I have never seen the "common reed" growing in more than about 2 feet of water, but in such situations it does not thrive nearly as well as in moist ground or in very shallow water.

This plant would not be likely to spread rapidly, and to become a pest, in a climate like New Zealand.

Preparing for Planting in Tidal and Non-Tidal Rivers.

The portion of the embankment where the "common reed" is to be planted should be temporarily protected on the water side either (1) by driving rather stout wooden stakes, placed almost close together, a foot or more into the mud to make them firm, finally leaving them about 18 inches above high-water mark, and the same height above water-level in non-tidal streams, or (2) by placing the stakes two or three feet apart and driving them far enough into the mud to make them firm, finally leaving them about 18 inches above high-water mark, and the same height above water-level in non-tidal streams. If the latter plan be adopted, branches of tea-tree or of any other kind of vegetation of a similar flexible nature should be interwoven between the stakes. These protecting fascines will only be required until the plants become established in their new positions, which will be in the course of a few months. Once the "common reed" becomes thoroughly established, no flood-waters will dislodge it, as it will bind the earth most effectively.

When and How to Plant.

The best time of the year to plant the "common reed" is in the spring of the year, just as new growth begins, and the quickest way to propagate it is by division of its extensively creeping root-stocks. Before dividing the plants, the old stems should be cut down nearly to the ground in order to facilitate lifting and transplanting. At the base of rich alluvial banks, no soil preparation, beyond levelling any great irregularities, will be necessary. The width of the plantation will depend upon circumstances. If the space be sufficiently wide to admit of two or three rows of roots so much the better. The quickest way of forming a plantation is to cut the grass in sections of about 1 foot or 18 inches square and sufficiently deep to secure a good percentage of the creeping root-stocks. The clumps should be planted about 3 feet apart, and no deeper in the soil than they stood when growing in the old plantation. Make the soil firm about the plants and then the operation is complete. The plants should be set out in such a way that the full tides and "freshes" will thoroughly irrigate their roots.

The Black Soil of the North-western Plains.

A. E. DARVALL,
Manager, Moree Experiment Farm.

Cultivation.

In California, it used to be a common saying, that to get adobe into good condition you had to "catch it just right," and that no one had been known to do so. Now adobe is practically the same as the black clay soil of these plains, and the foregoing remark shows exactly where the average farmer makes a mistake when he first commences to work with it. You do not want to "catch it just right," but on the contrary, plough when you can. As a matter of fact, the wetter it is and the bigger the clods that are left by the plough, the better the final results will be, and it is in failing to grasp this fact that the farmer goes wrong. This is not to be wondered at, as it is almost certain that he has learnt his farming on easily worked loamy soil, where a good ploughman leaves the land as clean and level as a billiard table, and where the harrow follows the plough, and the drill the harrow, in rapid succession, very often on the same day, where the farmer can say "next month I will put in such and such a paddock," and, barring heavy rains, do so.

Now, on this heavy clay, the ground must be ploughed when fairly wet; otherwise the plough will not stay in it; and the sooner this is done after the last crop has been taken off, the better. Plough deep, at least 6 inches, 8 is better, and leave the land in as rough a condition as possible; then let the sun, air, rain and, if in winter, the frost, get it into good condition. This all helps to mellow and sweeten it, and also allows the rain to get well down into the subsoil, which alone is a great advantage, as if left unploughed until just before the next crop goes in, any heavy rain will quickly puddle the surface, and the water, after penetrating a few inches, will begin to run off, instead of soaking in.

This weathering-down process pulverises the soil as finely as if it had been pounded up in a mortar; every shower causes the surface of the clods to swell, the sun and wind dry and crack them, minute fragments then drop off gradually, forming the moist, compact seed bed so necessary for crops of every kind. When this is accomplished, it will be found that the elements have done better work than could be done by days of harrowing, rolling and pulverising.

Now, for the sake of comparison, let us suppose that the land is treated in the same way that one would treat loamy soil. The land is ploughed and turned up in clods of various sizes; the harrow follows as soon as it is dry enough, and if gone over often enough, the surface appears more or less—chiefly less—pulverised; but underneath, the clods are still there, and as

deep as the plough has gone, spaces are left between them into which the air will get and dry out the whole. The drill coming after bucks over the clods, (the surface only of which the harrow has smoothed off), depositing the seed sometimes on the surface and sometimes 4 or 5 inches down in the cracks between them, but seldom at the depth that it is supposed to set it at. If a good rain comes just after sowing, some of the seed will be washed further down, whilst that resting on the top of a hard clod will have what little soil there was covering it washed off. If no rain, or only light showers come, then the case is worse, for there is at first enough moisture in the ground to germinate the seed, but the land will quickly dry out practically to the depth to which it has been ploughed, and the seed will be malted; but in any case, rain or no rain, the crop will be patchy and uneven.

Stock should not be turned into cultivation paddocks on this soil to eat off the stubble, unless the ground is very dry. Even then it should be only for a short time, and they should not be allowed to eat it bare, as the more vegetable matter is turned in the better the land will become, and the more easily it will work. This, if it needs any demonstration, can easily be proved by the superior fertility and friability of the soil where a tree or a bush has stood, or where there has been a stack of hay or straw.

Always plough the land up and down a gentle slope. The dead furrows, or clean outs, then become surface drains. If the land is ploughed across, they simply hold the water, which puddles the soil, and causes a thin stunted patch through the crop.

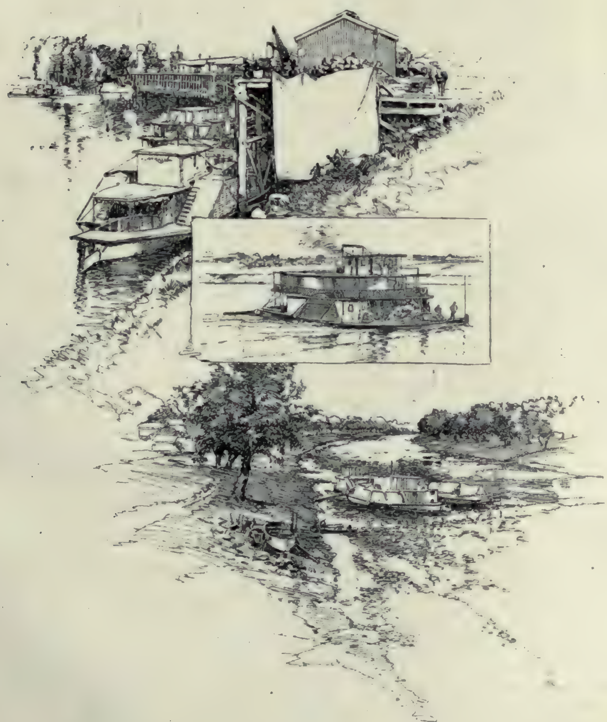
The disc plough, being self-cleaning, is undoubtedly the best for this soil, which, unless very wet or very dry, is sticky. The share of the mould board plough has to be constantly cleaned off with a spade, the clay balling on it and making it very heavy to draw and difficult to keep in the ground.

The treatment of the land after ploughing, and before a crop is sown, depends a great deal upon the rainfall during that period. Should good rains come shortly after the ploughing, there is pretty certain to be a crop of weeds. These must be got rid of before they seed, and also before they dry out the land. This may be done in two ways—either by keeping the land cultivated, a spring tooth harrow being probably the best for this purpose, which also helps to keep the ground moist and bring it into good tilth, or the land may be lightly ploughed again. This turns a certain amount of vegetable matter into the soil which is always beneficial, but it also dries it out more, and should certainly not be done less than two months before the next crop is due to go in, as a good rain cannot be depended upon to work it down again, if reploughed just before sowing.

If a drill is used, it is not necessary to harrow the land first, unless the ground has been packed by heavy rains, but if the seed is to be sown broadcast, it is absolutely essential to have the soil fine and loose on the surface. After the drill the roller must follow, and then a light harrow; or after broadcasting, the heavy harrow, roller and light harrow.

There is nothing to be feared in harrowing the crops after they are up, say to a height of $2\frac{1}{2}$ to 3 inches. By that time, they will be firmly rooted. Do

not, however, harrow them so long as the clay is moist enough to stick to the tines of the harrow, but directly it has got past that stage, harrow at least once a fortnight until the next rain comes, or until the crop is 9 or 10 inches high. One per cent. of the crop will not be pulled out if a light, adjustable harrow is used, with the tines set slightly back, and *kept clean.* This soil, when once it begins to crack, dries out very quickly, and the only way to prevent it is to keep a fine mulch on the surface. This can only be done by harrowing, and even if 50 per cent. of the crop were pulled out, it needs no argument to prove that it is better to save half than loose all. Once the plants are firmly rooted, however, it is wonderful what they will stand ; even rape, which is very brittle, can be harrowed with advantage until it is about 5 inches high.



Destruction of Sparrows by the Introduction of Owls.

A FEW months ago the Secretary of the Old Junee Progress Association asked for information as to the best methods of destroying sparrows, and referred to the statement that owls were reported to have been introduced successfully for this purpose into South Australia. Mr. Musson, of the Hawkesbury College, pointed out that in this State the hawk, the butcher bird, and the crow were destroying sparrows to some extent, and that owls had been imported into New Zealand with the same object.

The South Australian Agriculture Department reported that they had no experience in the matter, but from information received there seemed to be no doubt that owls materially assisted in keeping down the sparrows.

The New Zealand Department, in reply to our enquiry, stated that about three years ago the Otago Acclimatization Society made two importations of a species of owl known as *Carene noctua*, a native of Southern and Middle Europe, and from the particulars furnished it is evident that the advent of these strangers, and their subsequent operations, coincides with a remarkable decrease in the number of small birds, to which the owl is apparently a deadly enemy.

The information may be very satisfactory from one point of view, but, as both Mr. Musson, of the Hawkesbury Agricultural College, and Mr. Etheridge, of the Australian Museum, point out, the introduction of foreign birds and animals is attended with considerable danger in other directions. There is not only the possibility that we might be importing what might develop into another pest, but that the further destruction of our native birds might result in an additional increase of insect pests.

[The *Sydney Morning Herald*, 27th October, 1908.]

Sparrow Killers.

Referring to recent notice of birds destroying sparrows, in the *Agricultural Gazette*, August, 1908, p. 680, Mr. John W. Mellor (hon. secretary of the South Australian Ornithological Association) writes :— * * * * * * I am somewhat sceptical as to its (the Ground Cuckoo-Shrike's) "killing" propensities with the sparrow. It may worry it a bit, but that at most. I should like to have more evidence relating to this new departure in its life history before making it a fixed habit. The bird needs to be studied closely in its natural haunts before coming to any conclusion. The birds are naturally migratory. Other species here generally depart during the winter, returning about Christmas time, and are sometimes called Christmas birds on that account. They are totally protected in South Australia. A few stay with us at the Reedbeds and breed. I do not know whether the ground variety would do down south, for they have not come down of their own accord, although the way is quite open to them. Care needs to be exercised in introducing birds, for fear of their attacking our small native birds in addition to sparrows, and so doing more harm than good. A responsible person should be got to look into their habits before making any step of introduction, &c., and I would advise the collecting of data from the districts where the bird breeds, as it is here that the true propensities generally exist.

Testimony to Value of Expert Advice.

In October of last year Messrs. Baker Bros., gardeners, Great North Road, Five Dock, made application to the Department of Agriculture for advice in connection with the nature of the soil in their garden, which at that time was not producing vegetables satisfactorily, notwithstanding that the ordinary cultural methods which usually produce good early vegetables were employed. In their report which accompanied the three samples of soil forwarded for analysis, they stated that the vegetables did not seem to grow well at the start, although they seemed to make good progress later on. In similar soil in a garden next to theirs the vegetables seemed to be half-grown before theirs got a start. The samples of soil were submitted to Mr. F. B. Guthrie, Chemist, Department of Agriculture, for analysis and report. On the analyses and from the particulars accompanying the samples, Mr. Guthrie reported as follows:—

"The only serious fault noticeable about this soil is its frequent sour condition. It is fairly, though not well supplied with vegetable matter, is a light, easily worked loam of good water-holding power and capillarity, fairly well supplied with plant-food, though not rich; probably manuring will be necessary and will certainly be beneficial. The soil must be sweetened in the first place. Apply lime at the rate of about 1 ton per acre, freshly slacked or powdered lime (pamphlets were forwarded with analyses, giving full details regarding manures and liming)."

The advice *re* liming was followed by Messrs. Baker Bros., who now report as follows regarding the success that has followed the treatment and the information forwarded:—"It enabled us to understand the quality of our soil better, with the result that we put in vegetables best suited to the soil with splendid results.

"It may be interesting to state that we had pumpkins weighing up to 50 lb. and a heavy crop. This class of vegetable was very dear early in the season. We reaped the benefit of this as we were one of the first to have them on the market, clearing our stock off before the glut.

"On 10th July we weighed some cabbage of the Melbourne St. John variety, and they were over 13 lb. There are some exceptionally big ones left, and we believe when cut they will turn the scale at anything from 15 lb. to 19 lb."

Judging from the analyses, these soils had been used for market gardens for years, and constantly enriched with stable manure and bone-dust, which had made the sandy loams well supplied with nitrogen, potash, and phosphoric acid, certainly much above the average of similar soils in the county of Cumberland, derived from the decomposition of sandstone. But the continuous supplies of vegetable matter had increased the percentage of humus, and this had generated vegetable acids, probably through deficiency of subsoil drainage and aëration of the soil. Hence lime was of great benefit

in correcting the acidity in making the organic nitrogen more quickly available, and in liberating the potash from its insoluble compounds. All market gardeners and others cultivating black, peaty soils are advised to try moderate dressings of lime every third year. Do not apply it with or immediately before or after stable manure or any artificial manure containing ammonia. It is advisable to allow an interval of at least six weeks between the application of it and any other manure.

A Good Word for Barley Grass.

Mr. Percy K. Power, Hon. Secretary, Eastern Dorrigo Settlers' Progress Association, writes:—"In noting the search that is continually going on for new fodder plants as set forth by various articles that have from time to time appeared in the *Gazette*, and also in other journals, it appears to me that we often overlook the good things at our feet in our search in distant lands. I am a new settler in a new settlement, and as we have to build up our pasture lands with artificial pasture, I am deeply interested in all fodder plants, new and old. While admitting that Paspalum is a good summer grass, strong and hardy, standing a lot of hard weather, it does not provide for the severe winters we experience here, just the time when feed is most wanted.

"Silos are very good when you can make use of them, but they are practically out of the question at present, as it is impossible to harvest, economically, stuff to fill the silos with, at least, for three years after a 'new burn.' In the meantime we want a good winter grass.

"Having had over thirty years' experience of western fodder grasses, my thoughts, in studying the question, naturally reverted to fodder grasses I know. I have some yellow-flowered trefoil and barley grass growing here; carried here in horse feed. I have taken particular notice of them since I have become interested in the subject, and I found that the trefoil does not do too well at present, not as good as the ordinary white clover, but the barley-grass simply luxuriates in the soil and climate, grows all through the winter and stands any amount of frost. I know it to be a quick grower and of good feeding quality in its natural haunts, and I foresee the same result here with the improvement that its seeds (which are a nuisance, windy years especially, when it becomes bristley) will be knocked off by the summer rains and covered by the growing paspalum or clover. The seed can always be procured in the western district in good years. It is a prolific grower and seeder, and the seed can be raked up in bagfuls."

[Mr. Power, no doubt, writes from the point of view of the dairyman. Sheep-breeders would, however, consider well before encouraging the grass, as it is not at all desirable to have it in their pastures. It is a prolific seed-bearer, and the seeds ripen in October and November. To the seeds adhere long awns, which often are an inch long, and these are very troublesome to the salivary glands and eyes of sheep and other small herbivora, as well as deteriorating to the value of the wool. In sheep country containing this grass, it is usual to turn the sheep out of a paddock at seed time.—Ed.]

"Snail end" Tobacco dust.

INTERIM REPORT.

MESSRS. W. D. & H. O. Wills (Australia), Limited, 267-271, Castlereagh-street, Sydney, have forwarded a quantity of "Snail end" tobacco-dust insecticide and fertiliser to the Department for experimental purposes and report. The following particulars are also forwarded by the firm mentioned :—

The analysis is as follows :—

Nicotine ... 1·10 per cent. Ash .. 23·01 per cent.

The ash contains :—

Lime, 25·31 per cent. Potash, 31·00 per cent. Phosphoric acid, 4·86 per cent.

The price is £8 per ton delivered on trucks.

The following reports are now to hand.

As Insecticide.

The Fruit Expert reports :—

We have used it in connection with soft soap for making tobacco wash for Black Aphis.

The Poultry Expert, Hawkesbury College, reports :—

We have been using tobacco dust for seven or eight years, and it has been found very efficacious—equal to pyrethrum, and costs less.

Tobacco Dust as a Fertiliser.

The Principal of the Hawkesbury College reports :—

The test was conducted on three plots, one of which received no manure, one tobacco dust, and one a complete artificial manure.

The soil was fairly good pipeclay loam. It had been cropped with wheat the previous year which was cut for hay.

Immediately after harvesting the land was ploughed and fallowed until March, when it was reploughed and well worked. The tobacco dust was sown broadcast and harrowed in : the complete manure was applied in the drills.

The variety of Swede selected was Skirving's Purple Top, and was sown on 25th March in drills 2 feet 7 inches apart. The following rainfall was recorded during the experiment :—

March ...	1·68	June ...	·05	September	·57
April ...	1·37	July ...	1·83		——
May ...	·38	August ...	4·75	Total ...	10·63 inches.

During the first three months the rainfall was light and the growth considerably retarded. The rain in August was good, but although it enabled the crops to recover to a certain extent it was too late to be of much benefit. The following table gives the results :—

Yield of Swede turnips, harvested October 3, 1908.

Kind of Manure.	Quantity per acre.	Area of plot.	Yield per plot.	Yield per acre.
	tons. cwt. lb.		cwt. qr. lb.	tons. cwt. qr.
Superphosphate	0 2 0	1/50	2 2 16	6 12 0
Sulphate of potash	0 1 0	...	......	......
Sulphate of ammonia	0 0 95	...	......	......
Unmanured	......	1/50	2 0 0	5 0 0
Tobacco dust	1 0 0	1/50	1 2 22	4 4 3

Diseases in Stock.

STOCK BRANCH LEAFLET, No. 1.

BOTS IN SHEEP.

A REPORT was published in the *Agricultural Gazette,* in December, 1901, drawing attention to "bots" (or larvæ of the *Œstrus ovis*) being found in the frontal sinuses and horncores of the head of a sheep, upon which a *post mortem* examination was being made. The infestation of sheep by these parasites was described as being of a very rare occurrence in this State, as the case referred to was, it is believed, the first of its kind reported. Since then the *Œstrus ovis* has become so wide-spread in the eastern and central districts that, of late, numerous inquiries have been received as to the exact nature of the "grubs" found in the heads of sheep, and as to whether they have any connection with the various ailments the sheep in which they were found, suffered.

In order to bring the exact nature of this affection within the purview of sheepowners, the following information is published:—

The *Œstrus ovis,* Linn. (*Cephalomyia ovis,* Latreille),* is a small fly of greyish-yellow hue and slightly hairy, face yellow, buccal pieces testaceous. Upper surface of the thorax of a brownish-grey, granular and streaked by obscure or nebulous lines. Abdomen marbled and spotted with white, yellow, and black, covered with fine hairs behind, having a silky hue, wings hyaline and transparent, marked at their base by three black points. Length of body, about $\frac{1}{2}$ to $\frac{3}{4}$ of an inch.

The species is very wide-spread, being found throughout Europe, in Asia, Africa, the Canary Islands, and the two Americas. Like other *Œstridæ,* it lives in the perfect state during warm weather. It hides in the holes and crevices of fences and walls of sheep-folds, which it leaves when coupling time has arrived and the temperature is sufficiently high. The fecundated female now goes in search of sheep, which are afraid of its approach and huddle together in a dense pack with heads down. The sheep on the outside of the pack become greatly agitated, and rub their noses in the dust between their fore feet. According to Bracy Clark† they raise clouds of dust to deceive their assailants. As a sheep falls a victim, he generally breaks away from the rest of the flock at a gallop, holding his head towards the ground, often shaking it, snorting violently, and stamping furiously, in getting rid of his adversary. The nostril of the sheep becomes very sore and inflamed from the repeated attacks of the fly and from rubbing on the ground.

The fly, taking advantage of a favourable opportunity, deposits its eggs on or near the nostrils of the sheep. In a few days the eggs are hatched, and the young larvæ (scarcely visible to the naked eye) crawl into the nostrils, aided by means of two hooklets, and commence to feed on the mucus. In due course, they pass up the nasal chambers and gain the sinuses of the head, where they develop.

* Neumann's Parasites. † Steel "On Sheep."

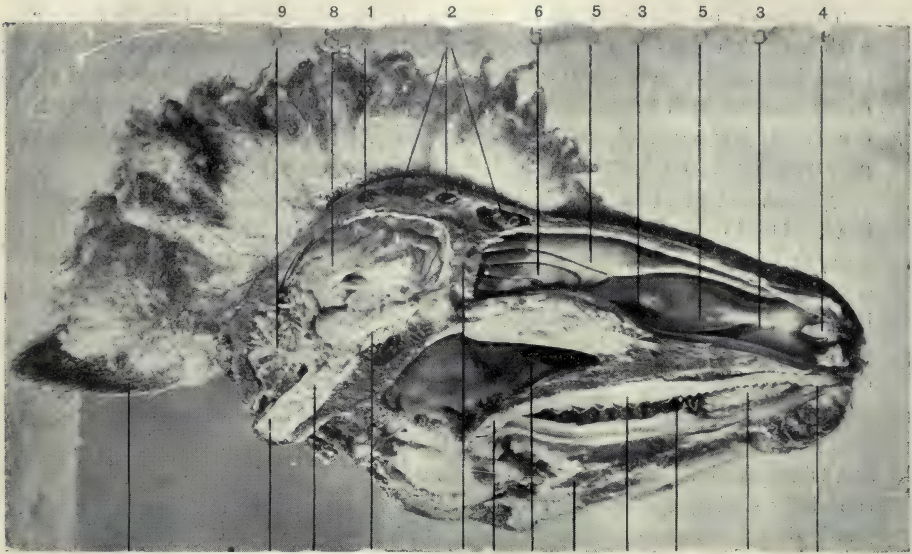
The young bots are of a white colour and transparent, but become darker with age. The adult bot is somewhat larger than the "stomach bot" of the horse, but smaller than the "warble bot" of the ox (*vide* illustrations 2 and 3), being from an inch to one inch and a quarter long, and one-third its length broad. It has a grub-like appearance, and has two brown patches or chitinous plates enclosed in a fleshy ring at its posterior extremity.

The bot or larva remains about ten months in the cavities of the sheep's head. Having attained complete maturity, it leaves its abode, passes into the nose, and is expelled through the nostril during one of the violent fits of snorting its presence excites. Twenty-four hours after its exit, it is transformed into a nymph, and the shell, which was at first soft and red, is now brown, then black, its upper surface being convex and the lower concave. The duration of the nymphosis is from a month to six weeks, when the issue of the perfect insect, or fly, occurs, and a new life cycle begins again.

Opinions differ as to the severity of the effects of bots in sheep. Youatt and Clark minimise them ; others attribute many fatalities to their presence, especially during the spring of the year. Even the occurrence of septic meningitis has been ascribed to them. It is, however, usual to find three or four larvæ in the frontal sinuses, which during life have given no indication of their presence. Most veterinary authorities agree that, as a rule, they rarely occasion any morbid disturbance, unless they are very numerous and advanced in development at the commencement of spring. The first sign of their presence is a discharge of mucus, often from one nostril only, at first clear and serous, but becoming turbid and thick. This condition is known as parasitic nasal "catarrh" or "ozœna." There is frequent sneezing and snorting, accompanied by expulsion of mucus, often blood-stained. The sheep lose condition, have irregular movements, and twist their heads occasionally as if in pain, symptoms which have led to this affection being mistaken for "sturdy" or "gid," caused by a hydatid (*Cœnurus cerebralis*) on the brain.

A number of preventive methods are practised to protect sheep from the attacks of the fly. A very old practice is that of turning up a few furrows in the paddock where the sheep are depastured, so that they may follow their natural instincts and bury their muzzles in the soil. The smearing of the sheep's noses with empyreumatic oils, or tar, is also carried out, but this is a tedious operation when large flocks have to be treated, and, at best, is one of ephemeral advantage only. A more satisfactory method is that suggested by Walker, which is to place a supply of Liverpool salt in long troughs, covered by lids perforated by holes about 2 inches in diameter, the margins of which are smeared with tar, or some other repellant substance, so that when the sheep take the salt, their muzzles are automatically dressed.

Many kinds of treatment have been made known, but few have yielded satisfactory results. Among those most commonly practised are the blowing of tobacco smoke from the tail end of a pipe up the nose ; (2) the fumigation with fumes of burning tar and sulphur in a suitable building ; (3) the injection of a mixture of turpentine, ether, and oil ; (4) trephining the skull and removing the infesting bots surgically.



Photographed by R. GRANT, *Health Dept.*

Fig. 1. Hemi-section of Sheep's Head.

1. Sinus leading to that of horn-core.
2. Frontal sinus, showing "bot" in common position.
3. Nasal passage. (No. 1 communicates with No. 2; No. 2 with No. 3.)
4. Opening of nostril leading into nasal passage.
5. The turbinated bones.
6. The lateral masses of the ethmoid.
7. Cribiform plate of the ethmoid bone, dividing the nasal from the cranial cavity.
8. The cerebrum.
9. Cerebellum, showing the arbor vitæ.
10. Base of brain.
11. Medulla oblongata.
12. Portion of spinal cord.
13. The external ear.
14. Posterior nares.
15. Soft palate.
16. Lower jaw.
17. Cavity of the mouth.
18. Molar teeth.
19. Papillæ on inside of cheek.
20. The mouth.

Fig. 2.
Group of Bots removed from head of Sheep.

(Natural size.)

Fig. 3.
Three Bots of Domesticated Animals (ventral aspect).

A The marble (or skin) bot of the ox.
B The bot of sheep.
C The stomach bot of the horse

The Poisonous Properties of Beans.

FROM THE JOURNAL OF THE BOARD OF AGRICULTURE.

IN 1901 the Imperial Institute received for investigation from the Director of the Station Agromonique, Mauritius, the beans of *Phaseolus lunatus*, a plant grown in that island for use as a green manure, the dark coloured beans of which had proved to be poisonous. It was found on investigation that these beans were capable of yielding considerable quantities of prussic acid, the origin of which was traced to the presence of a glucoside, to which the name phaseolunatin was given, and a ferment, which was able to decompose the glucoside with the formation of prussic acid.

A full account of this glucoside is given in a paper communicated by us to the Royal Society (*Proceedings of the Royal Soc.*, 1903, lxxii, 285). While this work was in progress, samples of beans known commercially as Paigya, Rangoon, or Burma beans, which were then being imported into this country in large quantities, were sent to the Imperial Institute for an opinion as to their suitability as feeding stuffs by various firms to whom consignments had been offered. Two varieties of these beans occur in commerce—the one pink, with small purple splotches, and distinguished as "red beans," the other pale cream in colour and known as "white beans." Numerous samples of the red beans were received, and each of these on examination was found to yield minute quantities of prussic acid. Only one sample of the white beans was received at this time, and from that no prussic acid could be obtained.

The red and white Rangoon beans, though as a rule lighter coloured, smaller, and less shrivelled than the Mauritius beans, exhibited certain resemblances, which indicated that they also were derived from *Phaseolus lunatus.* Such marked differences in colour as were shown by the three varieties are well known to occur in species of this genus, and from information subsequently received from India there appears to be no doubt that these Rangoon, Burma, or Paigya beans are produced by *Phaseolus lunatus*, the beans of which have long been known in India to be poisonous under some circumstances. Other vernacular names in use for these beans are "Lima" and "Duffin," the former being in common use in the United States.

In view of the fact that the white Rangoon beans examined at the Imperial Institute yielded no prussic acid, attempts were made to obtain the white beans of *Phaseolus lunatus* grown in other localities than India for comparison with them, and eventually "Haricots de Lima," grown in the south of France, were obtained through a firm of seedsmen in Paris. These were much larger than either the Mauritius or Indian beans and were cream-white in colour. They were examined and found to furnish no prussic acid.

These observations that the red Rangoon beans yielded traces of prussic acid and the white beans from two different sources none, confirmed the

statements recorded by various authors that the white beans of *Phaseolus lunatus* are safer than the red kinds. Thus Professor Church, in his "Food Grains of India" (p. 155), says :—"This is one of the species of *Phaseolus* which sometimes exhibits marked poisonous properties. It is desirable that great care should be taken in selecting for cultivation the best variety of Lima beans. The large oval white-seeded kinds, with at most a brown or black mark close to the hilum, are preferable to those with flattened reniform seeds having blotches of red or veinings of black."

On this point it is of interest to note that Cordemoy has stated ("Flore de l'île de la Réunion," 1895, p. 389) that in the wild state the beans of *Phaseolus lunatus* are purple and very poisonous; that on cultivation the colour of the seed becomes modified to a yellowish tint with stripes or violet splotches, and that in this state the beans are rarely poisonous; and lastly that, after prolonged cultivation, large white beans are produced which are harmless. This statement, taken in conjunction with the facts recorded above, seemed to indicate that by cultivation of the plant the beans become white and then no longer produce the glucoside capable of yielding prussic acid.

After carefully reviewing the facts in consultation with the Director of the Imperial Institute, the Board of Agriculture came to the conclusion that it was desirable at this stage to warn consumers against the use of red and dark coloured beans of *Phaseolus lunatus.* (*Journal*, December, 1902, p. 373.)

In 1905 interest in the matter of the production of prussic acid by the beans of *Phaseolus lunatus* was reawakened by the importation into the United Kingdom of large quantities of beans from Java, to the use of which, for feeding cattle, numerous cases of poisoning were traced, especially in Scotland.*

Samples of these "Java beans" were received at the Imperial Institute from various firms. They closely resembled the beans of *Phaseolus lunatus*, as received from Mauritius, and on examination proved, like these, to yield comparatively large quantities of prussic acid. These "Java beans" were imported, not only into the United Kingdom, but also into Holland, Germany, and France, and in all three countries similar poisoning cases occurred.

At this period a systematic investigation of the beans of *Phaseolus lunatus*, as produced in different localities, was undertaken by Professor Guignard ("Comptes Rendus," 1906, cxlvii, 545), and an examination of Java beans was made by M. Kohn-Abrest (*ibid.*, p. 586). Both these investigators confirmed the observations made at the Imperial Institute that the Java beans yielded comparatively large quantities of hydrocyanic acid. Professor Guignard also found that red Rangoon beans yielded small amounts of prussic acid, but he stated that the white cultivated beans of *Phaseolus lunatus*, such as those produced in Madagascar, Rangoon, Southern France, &c., also yielded prussic acid, though in most cases only in mere traces.

* *Journal*, March, 1906, Vol. xii, p. 742, and April, 1906, Vol. xiii, p. 52.

Messrs. Tatlock and Thomson examined a number of commercial samples of Java, Rangoon, and haricot beans, and their results, which also indicate that some samples of the white beans of *Phaseolus lunatus* yield prussic acid, are given in the *Analyst* for August, 1906.

In March, 1907, Mr. Hendrick, chemist to the Highland and Agricultural Society of Scotland, sent to the Imperial Institute a sample of white Rangoon beans, which he had found on examination yielded ·016 per cent. of prussic acid.

In May, 1907, the Board of Agriculture called the attention of the Director of the Imperial Institute to the fact that white Rangoon beans had been found in some instances to yield prussic acid, and as it seemed desirable that the matter should be further investigated, a request was made to the Board of Agriculture for samples of Rangoon beans as sold throughout the United Kingdom for feeding purposes. A series of such samples, collected mainly in Scotland and the north of England by one of the Board's Inspectors, was received last July.

The Imperial Institute also obtained a number of samples of white Burma beans and other white beans of *Phaseolus lunatus* from firms in London and Paris, so that the inquiry could be made as general as possible.

The results of the examination of these samples are given in the following table:—

SAMPLES received from the Board of Agriculture.

	Prussic acid. Per cent.
Red Rangoon beans, obtained at Leith	0·024
White ,, ,, ...	Traces, too small to estimate.
Hand-picked white Rangoon beans, obtained in Newcastle	0·020
White Rangoon beans, obtained in Newcastle	0·018

SAMPLES received from London dealers.

	Prussic acid. Per cent.
Firm A { White Rangoon beans	0·025
Firm A { ,, ,, hand-picked	0·027
Firm B.—White Burma beans	0·026
Firm C.—Tinned white Lima beans of American origin ...	None.

SAMPLES received from seedsmen in Paris, and guaranteed to be produced by *Phaseolus lunatus.*

	Prussic acid.
Haricot de Lima, large cream	None.
,, Sieva	Traces, too small to estimate.

These results indicate that, whilst there are varieties of the white beans of *Phaseolus lunatus* on the market which yield no prussic acid, some of the white Rangoon or Burma beans at present available in commerce yield this substance in quantities of some importance having regard to their use as a feeding stuff, whilst others, such as the white Rangoon beans obtained at Leith, yield mere traces.

It should be pointed out, however, that the quantities of prussic acid yielded both by red and white Rangoon beans are much smaller than those

obtained from the Java and Mauritius beans. As a very large number of determinations of the amounts of prussic acid yielded by these various classes of beans have now been made, it may be useful to summarise the results in tabular form.

Origin and Colours of Beans.	Dunstan, Henry, and Auld.	Guignard.	Kohn-Abrest.	Tatlock and Thomson.
	Prussic acid per cent.	Prussic acid per cent.	Prussic acid per cent.	Prussic acid per cent.
JAVA.				
Mixed beans of all colours	0·038–0·123	0·052–0·012	......	0·027–0·137
Black beans	0·107	0·046	.....	0·042
Purplish-black beans	0·116	.....	0·052	0·031
Wine-red beans	......	......	0·058	......
Reddish-brown beans	......	.. ...	0·037	0·038
Bright maroon beans	......	......	0·050	......
Light brown beans with dark spots	0·103	......	0·041	0·038
Pale brown with dark spots ..	0·104	......	0·126	.....
Cream white	0·105–0·110	0·052	0·037	0·027
Black with white stripes	0·062	......	0·058	......
MAURITIUS.				
Purplish-black	0·088	......	......	.....
Brown	0·087	.. ...	......	......
Light brown	0·041	......	......	......
BURMA.				
Pale brown with purple spots ..	0·004–0·024	0·011	......	0·0009
Cream white	Nil–0·027	0·006	......	
FRANCE.				
"Haricots de Lima," large cream...	Nil.	Traces.	......	......
"Haricots de Sieva," large cream..	Traces.	0·004–0·008	......	......
"Haricots de Cap Marbre" ...	Traces.	......	......	......
MADAGASCAR.				
White	......	0·008	... ..	......

In addition to the foregoing, a number of miscellaneous samples of beans have been received at the Imperial Institute for examination in connection with this inquiry, and as one of these, which is probably not the product of *Phaseolus lunatus*, also yields traces of prussic acid, it may be of interest to record the results here.

SAMPLES received from the Board of Agriculture.

	Prussic acid.
"Large white haricots" obtained in Glasgow	Nil.
"Small white haricots," said to be of Hungarian origin	Nil.

SAMPLES obtained from firms in London.

		Prussic acid.
Firm A.	"Butter beans," large white	Traces.
	"Dark red haricots"	Nil.
Firm B.—Danubian beans		Nil.

SAMPLES obtained in Paris.

	Prussic acid.
Haricots d'Alger, blanc à ramés	Nil.
Haricots d'Alger, noir à ramés	Nil.

It is of interest to note that the "butter beans" now largely sold for human food in this country furnish traces of prussic acid, but the other "haricot" beans included in this group, which are probably mainly, if not wholly, derived from *Phaseolus vulgaris*, yield none.

It will be seen on comparing the results quoted in these two sets of tables, that all the earlier analyses indicate the production by white Burma beans of no prussic acid, or only traces; fairly large quantities (0·016 to 0·026) per cent. have, so far as is known, only been recorded for consignments of white Burma beans imported during 1907. Even these quantities are, however, only about one-fifth of those yielded by some specimens of Java beans, which were coloured.

No explanation of this unfavourable change in the quality of white Burma beans can be given at present.

It has been suggested recently by the French Consul at Rangoon that consignments of Rangoon beans may contain small quantities of the poisonous beans of *Psophocarpus tetra gonolobus*, and that their production of prussic acid may be due to such inclusions. The only extraneous beans noticed in samples, both of Rangoon and Java beans examined at the Imperial Institute, have been those of *Dolichos lablab*, which Dr. Leather has shown also yield small quantities of prussic acid. None of the investigators who have worked on Rangoon beans have recorded the occurrence among them of *Phsophocarpus tetragonolobus* beans, so that there is no evidence to support the Consul's suggestion, whilst there is plenty of evidence that the Rangoon beans themselves actually yield prussic acid.

Although both red and white Burma beans have been imported in large quantities into the United Kingdom, and used for feeding cattle during the last few years, no cases of poisoning have so far been traced to them, but it is obvious that if the amount of prussic acid furnished by different consignments of these beans may vary over as wide a range as is shown by the figures quoted above, the use of these beans for feeding cattle may be attended with some danger.

There is nothing on record to show what ill effects—if any—are produced by the long-continued use of feeding materials capable of producing small quantities of prussic acid, but the following facts are of some interest in this connection. It was shown by Jorissen and Hairs, as long ago as 1888, that ground linseed, when placed in contact with water, yields prussic acid, and these authors found that this was due to to the interaction of a glucoside and ferment. Recently, in conjunction with Dr. Auld, we have re-examined the glucoside and ferment of linseed, and found that they are identical with the cyano-genetic glucoside and ferment of the beans of *Phaseolus lunatus*. (*Proc. Roy. Soc.*, 1906, B. lxxviii, 152.) Since in the mere expression of oil from linseed the glucoside is not destroyed, it became of interest to ascertain how much prussic acid is furnished by the linseed cake commonly used as a feeding stuff for cattle in this country. Samples of linseed cake were, therefore, obtained from two of the principal makers of this product in the United Kingdom. The samples of cake were both of the highest quality,

and the linseed from which they were made was guaranteed by the firms to contain a minimum of 98 per cent. of true linseed. The amount of prussic acid yielded by the two samples was estimated and found to be as follows:—

	Prussic acid. Per cent.
Sample No. 1	0·035
,, No. 2	0·041

These quantities, it will be seen, are about 50 per cent. greater than those obtained from any of the samples of Burma beans examined. Although cases of the poisoning of cattle by the green stems of linseed have been recorded in India, there are, so far as is known, no cases of poisoning of cattle by linseed cake on record in this country.

There is, however, one important difference between the "availability" of prussic acid in the beans of *Phaseolus lunatus* and in the linseed cake of commerce. The former when ground and placed in water develop prussic acid immediately, but no prussic acid is formed when ground linseed cake is placed in water. This difference appears to be due to the fact that linseed cake is now made by hot expression of the oil, and the heat applied in this process is sufficient to destroy the activity of the ferment, to the effect of which on the glucoside contained in the linseed, the liberation of prussic acid is due. There is, however, always the possibility that the prussic acid yielding glucoside may be decomposed by ferments present in other feeding stuffs used along with the linseed cake, even if it is not acted on by intestinal ferments after ingestion.

In connection with this subject, it may be of interest to mention what is known regarding the use of cassava in tropical countries. Two varieties of this plant, the bitter and the sweet, are known, and it was long supposed that only the roots of the bitter sort yielded prussic acid and were toxic. Recent investigations have, however, shown that at least in the West Indies both the sweet and the bitter varieties yield similar amounts of prussic acid. Our investigations have shown that the origin of prussic acid in cassava is the same as in the beans of *Phaseolus lunatus* and linseed, viz.:—the interaction of phaseolunatin and a ferment. (*Proc. Roy. Soc.*, 1906, B, lxxvii, 152.) In preparing meal from cassava roots, these are usually rasped into a coarse powder, and the latter thoroughly washed. In this process the glucoside is brought into contact with the ferment and completely decomposed, the prussic acid formed being washed away by the water, so that it can be understood readily enough that meal so prepared is innocuous. Large quantities of cassava are also used as a vegetable, being boiled or baked in the same manner as potatoes. Treatment of this kind will destroy the activity of the ferment, but will not necessarily affect the glucoside, so that boiled or baked cassava is in much the same position as hot-pressed linseed cake, *i.e.*, it contains a glucoside capable of yielding prussic acid, but is harmless so long as it is not in contact with a ferment capable of decomposing the glucoside.

Numerous cases of poisoning by cassava are on record, but these seem to have been caused invariably by the consumption of raw cassava. It would seem, therefore, that in the cases of linseed and cassava, the application of enough heat to destroy the activity of the enzyme present renders these materials harmless, and the question arises as to whether similar treatment would not be efficacious in the case of Rangoon beans.

The statement has been made by exporters of Java beans that the latter become safe to use after being boiled in water, and Messrs. Tatlock and Thomson have stated (*loc. cit.*) that when Java beans are steeped in water and afterwards boiled, a considerable proportion of the prussic acid yielding glucoside is removed. Experiments made at the Imperial Institute with Java beans have shown, however, that practically no change in the quantity of glucoside present is effected by this means, but as the activity of the enzyme is destroyed, the ground boiled beans no longer liberate prussic acid when mixed with water.

There is on record one case which seems to indicate that this treatment of Java beans is insufficient as a precaution against poisoning. Thus Robertson and Wynne state (*Zeit. Anal. Chim.*, 1905, xliv, 735) that four persons out of seven who had made a meal of *cooked* "Kratok" beans (Kratok is a vernacular name for Java beans in use in Holland and Germany) died, and in each case clear proof of poisoning by prussic acid was obtained.

In view of the large interests concerned in the trade in Rangoon beans, and as, apart from the prussic acid they yield, they appear to be a useful and nutritious feeding stuff, it seems desirable that the question of their suitability for use as a feeding material should be definitely settled. This is all the more important, as there is reason to believe that the white beans may come into use as a human food, since they closely resemble small haricot beans in appearance.

Until this question has been investigated it is undesirable that any further definite advice should be given to discontinue the use of Rangoon beans, since in spite of the fact that both the red and white varieties have now been shown to yield prussic acid, there is at present no evidence that this is formed in quantity sufficient to be injurious, and although these beans have been used as a feeding stuff now for some years, no poisoning cases have been traced to them so far as is known. At the same time, since the beans yield prussic acid in varying quantity, it is clearly not permissible to recommend them for use as a feeding material. All that can fairly be done at the moment is to place the facts on record.

Orchard Notes.

W. J. ALLEN.

Cultivation.—At the present time the orchards in a good many districts are beginning to feel the effect of the prolonged dry weather, and therefore, when rain falls, the grower should lose no time, as soon as the land is dry enough, in getting his cultivators to work, in order to stir the soil and prevent as far as possible any undue evaporation of the moisture.

Codling moth.—Growers of pears, apples, and quinces will find that the strictest attention is necessary to the bandaging of trees, as also to the picking up and from the trees of all infested fruit, if they hope to market anything like a decent percentage of clean fruit. The bandages must be examined at intervals of seven days, and all grubs which are found hidden underneath destroyed, and the fruit picked up every few days, and either boiled or burnt, so that the grubs cannot possibly escape alive.

Fruit fly.—All infested fruit, whether on the tree or on the ground, must be gathered and destroyed, by boiling or burning, and no fruit must be allowed to remain on the ground longer than three days before being picked up.

Red and other Scales on Citrus-trees.—If the trees are in good growing condition, fumigating or spraying may be safely carried on this month, but where trees are suffering from the effects of want of moisture, or are at all weak, they should not be treated under any consideration, as either spraying or fumigating would, under such circumstances, be harmful to the tree. The lower the temperature the better will the trees stand either of these processes; therefore, never treat trees on a hot day; in fact, during this month fumigating gives best results if carried on at night. When it is found necessary, trees may be sprayed with Bordeaux mixture after fumigating, but under no circumstances must a tree be fumigated after it is sprayed with that mixture.

Fruit-curing.—The last of the apricot crop and the first of the better varieties of peaches for drying purposes will be ripening this month. See that such fruits are handled properly, and do not allow the cured product to become over-dry. As soon as properly processed, store in bags until they are to be packed. Pamphlets on Fruit-curing can be had on application to the Department of Agriculture.

Green manuring.—Do not fail to order vetches, peas, rape-seed, or whatever crop it is intended to sow among the trees for green manure, as early as possible, as such crops should be sown without fail early in March in order that they may put on good growth before being turned under, and before

the rains have ceased to fall in the spring. There are many orchards which could be made more productive if the owners would only give a little more attention to the proper manuring and working of same.

Grey Field Peas for Green Manuring.

Oranges on the South Coast.—At the Berry Show last November some very fine oranges, which were grown in that district, were shown. If there is much land available such as these were grown on, it would be well for growers to pay more attention to orange culture, as the fruit was of good colour, size, and flavour. Inspector Jones sent me a sample of Navels, which I received on the 14th December. The fruit was in excellent condition for this variety, which does not usually keep until the middle of December in many districts.

Arsenate of Lead.—Swift's Arsenate of Lead has given every satisfaction with us, and all who have used it, and I have not heard of an instance in which this mixture has done any damage to either foliage or fruit, whilst on the other hand I have heard of several instances of leaves and fruit being burned by growers who have tried to make their own arsenate of lead, or even where the local chemists have tried to mix same.

Owing to an error in last month's notes I omitted to mention that all fallen and infested fruit should be boiled before being fed to stock. According to the Act this is absolutely essential, as a certain number of grubs always escape unless the fruit is first boiled.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Sub-Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1909.

Society.	Secretary.	Date.
Dapto A. and H. Society ...	G. A. McPhail ...	Jan 13, 14
Albion Park A. and H. Society...	H. G. Fraser ...	,, 20, 21
Kiama A. Association ...	R. R. Somerville...	,, 26, 27
Gosford A. and H. Association...	W. E. Kirkness ...	,, 29, 30
Alstonville A. Society ...	W. W. Monaghan	Feb. 3, 4
Coramba District P., A., and H. Society ...	H. E. Hindmarsh	,, 3, 4
Wollongong A., H., and I. Association ...	F. W. Philpotts ...	,, 4, 5, 6
Moruya A. and P. Society ...	John Jeffery ...	,, 10, 11
Shoalhaven A. and H. Association, Nowra ...	Henry Rauch ...	,, 10, 11
Guyra P., A., and H. Association ...	P. N. Stevenson...	,, 16, 17
Luddenham A. and H. Society...	W. Booth... ...	,, 16, 17
Pambula A., H., and P. Society ...	J. B. Wilkins ...	,, 17, 18
Kangaroo Valley ...	E. G. Williams ...	,, 18, 19
Wyong A. Association ...	J. C. Martin ...	,, 19, 20
Tamworth A. Association ...	J. R. Wood ...	,, 23, 24, 25
Central Cumberland A. and H. Association ..	H. A. Best ...	,, 24, 25
Manning River A. and H. Association, Taree ...	S. Whitehead ...	,, 24, 25
Tumut A. and P. Association ...	E. H. Vyner ...	,, 24, 25
Ulladulla A. and H Association ...	Jno. Boag... ...	,, 24, 25
Gunning P., A., and I. Society...	W. T. Plumb ...	,, 25, 26
Nambucca A. and H. Association, Macksville ...	M. Wallace ...	,, 25, 26
Robertson A. and H. Society ...	R. J. Ferguson ...	,, 25, 26
Tenterfield P., A., and M. ...	F. W. Hoskins ...	Mar. 2 to 6
Bangalow A. and I. Society ...	W. H. Reading ...	,, 2, 3, 4
Bega A., P., and H. Society ...	W. A. Züegel ...	,, 3, 4
Braidwood P., A., and H. Association ...	L. Chapman ...	,, 3, 4
Bellinger River A. Association...	S. S. Hindmarsh ..	,, 3, 4, 5
Nepean District A., H , and I. Society, Penrith ...	Percy J. Smith ...	,, 4, 5
Taralga A., P., and H. Society...	Chas. Ross. ...	,, 4, 5
Berrima District A., H., and I. Society, Moss Vale...	I. Cullen	,, 4, 5, 6
Bombala Exhibition Society ...	W. G. Tweedie ...	,, 9, 10
Gloucester Show	Edward Rye ...	,, 9, 10, 11
The P. and A. A. of Central New England, Glen Innes	George A Priest...	,, 9, 10, 11
Molong P. and A. Association ...	Charles E. Archer	,, 10
Campbelltown Agricultural Association ...	Fred Sheather ...	,, 10, 11
Tumbarumba and Upper Murray P. and A. Society...	E. W. Figures ...	,, 10, 11
Bowraville A. Association ...	C. Moseley ...	,, 11, 12
Crookwell A., P., and H. Society ...	M. P. Levy ...	,, 11, 12
Oberon A., H., and P. Association ...	W. Mineham ...	,, 11, 12
Newcastle A., H., and I. Society ...	C. W. Donnelly ...	,, 11, 12, 13
Gulgong A. and P. Association...	S. J. Cox	,, 16, 17
Inverell P. and A. Association...	J. McIlveen ...	,, 16, 17, 18
Camden A., H., and I. Society ...	C. A. Thompson ...	,, 17, 18, 19
Armidale and New England P., A., and H., Association.	A. McArthur ...	,, 17, 18, 19, 20

Society.	Secretary.	Date.
Cobargo A., P., and H. Society	T. Kennelly	Mar. 18, 19
Port Macquarie and Hastings District A. and H. Soc.	W. A. Spence	,, 18, 19
Goulburn A., P., and H. Society	J. T. Roberts.	,, 18, 19, 20
Blayney A. and P. Association	E. J. Dann	,, 23, 24
Southern New England P. and A. Association	W. C. McCrossin..	,, 23, 24
Hunter River A. and H. Association	C. J. H. King	,, 23, 24, 25
Quirindi P., A., and H. Association	W. P. B. Hungerford..	,, 24, 25
Yass P. and A. Association	Will Thomson	,, 24, 25
Macleay A., H., and I. Association	E. Weeks ...	,, 24, 25, 26
Warialda P. and A. Association	W. B. Geddes	,, 24, 25, 26
Mudgee A. Society	H. Lamerton	,, 24, 25, 26
Clarence P. and A. Society, Grafton	T. T. Bawden	,, 24, 25, 26
Horticultural Society of N.S.W.	H. H. Bradley	,, 25
Gundagai P. and A. Society	A. Elworthy	,, 30, 31
Lower Clarence A. Society	Geo. Davis	,, 30, 31
Murrumburrah P., A., and I. Association	J. A. Foley	,, 30, 31
Walcha P. and A. Association	J. N. Campbell	,, 30, 31
Bathurst A., H., and P. Association	G. W. Thompson..	,, 30, 31, Apl. 1, 2
Cooma P. and A. Association	C. J. Walmsley	Mar. 31, Apl. 1, 2
Upper Hunter P. and A. Assoc., Muswellbrook	J. M. Campbell	Mar. 31, Apl. 1, 2
Royal Agricultural Society, Sydney	H. M. Somer	Apl. 6 to 14
Orange A. and P. Association	W. Tanner	,, 21, 22, 23
Narrabri P., A., and H. Association	W. H. Ross	,, 27, 28, 29
Richmond River A., H., and P. Society	D. S. Rayner	,, 28, 29
Wellington A. and P. Association	A. E. Rotton	,, 28, 29
Upper Manning A. and H. Association, Wingham	D. Stewart, jun.	,, 29, 30
Moree P. and A. Society	D. E. Kirkby	May 4, 5, 6
Dubbo P., A., and H. Association	Fred Weston	,, 5, 6
Durham A. and H. Association, Dungog	C. E. Grant	,, 5, 6
Coonamble P. and A. Association	J. M. Rees	,, 12, 13
Hawkesbury District A. Association	C. S. Guest	,, 13, 14, 15
Central Australian P. and A. Association, Bourke	G. W. Tull	,, 19, 20
N.S.W. Sheepbreeders' Association	A. H. Prince	June 30, July 1, 2, 3
Pastoral and Agricultural Society of Deniliquin	L. Harrison	July 15, 16
Corowa P., A., and H. Association	J. D. Fraser	Aug. 17, 18
Forbes P., A., and H. Association	N. A. Read	,, 18, 19
Murrumbidgee P. and A. Association, Wagga Wagga	A. F. D. White	,, 24, 25, 26
Parkes P., A., and H. Association	G. W. Seaborn	,, 25, 26
Northern A. Association, Singleton	F. A. Bennett	,, 25, 26, 27
Grenfell P., A., and H. Association	Geo. Cousins	,, 31, Sept. 1
Junee P., A., and H. Association	T. C. Humphrys	Sept. 1, 2
Lockhart A. and P. Society	H. Parnaby	,, 7, 8
Germanton P. and A. Society	James S. Stewart..	,, 8, 9
Cootamundra A., P., H., and I. Association	W. E. Williams	,, 14, 15
Albury and Border P., A., and H. Society	W. I. Johnson	,, 14, 15, 16
Henty P. and A. Society	P. H. Paech	,, 28, 29

[1 Plate.]

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Agricultural Gazette of New South Wales.

Some Common Diseases of Dairy Cattle

MAX HENRY, M.R.C.V.S., Government Veterinary Surgeon.

IN the following paper those diseases of dairy cattle, which are of most frequent occurrence in this State, and which cause the greatest and most constant loss to dairy-farmers, are shortly dealt with.

It has not been attempted to give a full or detailed description of any disease, but to describe those features of each disease which are most likely to make themselves manifest to a layman, and to give measures of treatment which can readily be carried out without expert assistance, and at the same time means are suggested by which the farmers can reasonably hope to expel the disease in question from his herd and to prevent its recurrence. But though these notes may assist the farmer in diagnosis and treating his cattle, it must be remembered that in almost every case there are measures at the command of the veterinarian which the farmer cannot utilise, and therefore where valuable animals are concerned professional advice should be obtained when possible.

The diseases dealt with are divided into infectious and non-infectious. Those coming under the first heading are tuberculosis, actinomycosis, pleuro-pneumonia, anthrax, contagious abortion, contagious mammitis, cancer, blackleg, white scour and lung disease in calves, ophthalmia, and ringworm. Under the second are placed parturient toxæmia (milk-fever), tympanitis, impaction of the omasum, retention of the afterbirth, and sporadic abortion.

INFECTIOUS DISEASES.

Tuberculosis.

Amongst the many diseases to which dairy cattle are subject, none causes greater loss or is of more importance than tuberculosis, both on account of its highly contagious character and the danger of contracting the disease which human beings undergo from the consumption of affected meat and milk. It is due to a specific organism which may gain entrance to the body through the lungs or the intestines, though recent experiment has shown that in all probability the majority of cases are due to intestinal infection.

The bacteria after gaining entrance to the body settle in certain glands, particularly the lymphatic glands ("kernels"), the lungs, and the liver.

The glands most often affected are those in the throat and between the lungs, in front of the shoulder, in the flank, and above the udder. As a result of the bacteria attacking these glands, abscesses are formed and the glands become enlarged and hard, shaped like an egg or a ball, and containing a considerable quantity of cheesy or semi-liquid yellow material.

This disease is all the more dangerous from the fact that a cow may be infected and be a source of contagion to other cattle without showing any definite symptoms, and she may remain in this condition for a long period. This is especially so in tuberculosis of the lungs, as when any of the glands of the throat or close under the skin are affected the enlarged glands can usually be detected. In some cases of tuberculosis of the lungs from an early stage, and in most when the disease reaches a certain state, the following symptoms are noticed :—The animal's coat is dull and staring, she loses flesh, and has a dry hacking cough—which is particularly noticable if she is made to run or to get up suddenly when lying down in the paddock—is constant, and becomes worse as the disease progresses. If the glands of the throat are enlarged, the enlargement may be visible, and in some cases presses on the windpipe so that the cow snores especially after exertion, and carries her head poked out almost in a straight line with her body. Enlarged glands can also be felt when they occur in front of the shoulder, along the course of the windpipe, in the flank, and above and behind the udder. A not uncommon symptom is persistent diarrhœa, and a cow which is constantly bulling should be looked on with suspicion.

There is seldom any noticeable change in the milk unless the udder becomes very badly affected, when it will be poor and watery. It is commonly held by farmers that because the milk appears to be all right, therefore there is not likely to be any disease of the udder, but that is not so.

Post-mortem appearances.—When a cow suffering from tuberculosis is killed and opened, the diseased parts will be easily recognised from the presence of abscesses of various sizes. As has been mentioned before, these may be found in any of the lymphatic glands (kernels) in the lungs and liver, sometimes in the womb, the kidneys, or the udder, and in the bull in the testicles. The contents of these abscesses may be firm and yellow, especially in glands; but sometimes are fairly liquid. In advanced cases the pleura (lining of the chest) and the peritoneum (lining of the abdomen) will show a number of little growths known as "grapes," and some of these if cut into will contain the usual cheesy material.

Treatment.—There is no known cure for this disease, and treatment, even in the earliest stages, is useless. The only thing to be done by any farmer valuing the health of his herd is to destroy the diseased beast as soon as the disease is noticed.

Prevention.—Although curative treatment as stated is useless, a very great deal can be done in the way of prevention. In the first place no diseased animal should be kept in the herd a day longer than necessary. In the second place the feeding of the calf must be carefully attended to, for there appears no doubt that many cases of tuberculosis are contracted while the animal is young, but do not show any definite symptoms for a long time, and such cases are due to the calf taking in tubercle bacilli with its food. It is a very rare thing for the calf to be born with tuberculosis, but it is a very common thing for the calf of a tuberculous cow to contract the disease from its mother if she is allowed to suckle it, or if it is fed on whole or skim milk

from a herd containing tuberculous cattle. Therefore the greatest cleanliness is necessary in feeding calves; wooden troughs which absorb moisture and are with difficulty cleaned and a wooden tub for keeping the calves' milk in, and in which a crust of dried milk is allowed to form, are simply breeding-grounds for all kinds of bacteria, and as such are dangerous. Metal buckets should be used for feeding and a metal tub for the milk, and all should be scalded or steamed every day, and the milk, whether skim or whole, should be sterilised, that is, brought to a temperature between 180 deg. Fahr. and boiling-point, and kept at it for a quarter of an hour. This is especially advisable in those cases where calves are fed on skim milk from a creamery, since one diseased herd supplying the creamery might spread the disease amongst any number of healthy ones. No suspicious cow should be used to rear calves as is so often done, as such a method is sure to result in the spread of the disease. Bulls should be obtained from herds known to be healthy, and whenever possible tested before being introduced into the herd. By these measures, together with cleanliness of bails, sheds, &c., much may be done to cleanse a herd from the disease and keep it clean.

Although it is often difficult to determine whether a cow is suffering from tuberculosis or not by examination, there is in tuberculin, an agent which, for all practical purposes, may be regarded as infallible. By means of it a certain diagnosis can at once be made, and as it is absolutely safe—for contrary to opinions sometimes expressed, it is quite impossible for tuberculin to cause tuberculosis since it contains no bacilli—its assistance in the hands of professional and skilled men should be more often invoked by the farmer than is at present the case.

Actinomycosis—"Wooden-tongue," "Lumpy-jaw."

A contagious disease of cattle, due to a fungus and affecting the jaws, tongue, lips, and rarely the udder and lungs of cattle. In contradiction to tuberculosis this is a purely local disease and makes itself visible at a very early stage. The commonest seat of the disease is probably the lower jaw, to which the organism gains access by means of a cut or a decayed tooth. A swelling forms, which is hard and bony, gradually enlarges, and if left a sufficient length of time, softens at one or more points, breaks, and discharges a thick yellowish pus. The resulting wound may heal up for a time, but will break out again at the same or another place, and the whole jawbone and the muscles round will be involved. If the cow is killed, the bone of the jaw will be found "honeycombed" and very much enlarged, and outside it there will be thick, white, gristle-like tissue with patches of yellowish pus. The same lesions occur in the upper jaw, most often just below and in front of the eye. If the tongue or lip is affected the part swells and becomes hard and nodular, the nodules showing centres of pus if cut into.

Occasionally the glands of the neck may be affected, or the lungs, or the udder, but these lesions are rare. If the case is seen in the early stages it may be treated with 2 or 3 drachm doses of potassium iodide given daily, but it is a long and expensive treatment, and, except in the case of a beast

of considerable value, the expense may soon exceed the value of the animal, while the results are by no means certain. Slaughter of the affected beast is the best course to adopt, as she may infect the grass and paddocks and so other animals may contract the disease.

Pleuro-pneumonia.

This is a highly contagious disease affecting cattle only, and one which, were it not for strict and effective quarantine regulations, would probably cause more loss than any other disease of cattle known in Australia. Fortunately, it is also a disease which can be comparatively easily controlled. This is due to the fact that in most cases immediate contagion is necessary for the spread of the disease from one beast to another, the majority of cases being contracted from the breath of a diseased animal. The disease is due to an extremely minute organism which gains extrance to the lungs and there sets up an intensive and characteristic inflammation. An animal is usually infected for two or three weeks, and sometimes longer, before any symptoms are shown, though if the temperature were taken it would be found a little higher than normal. The first symptom noticed will probably be in an animal standing away by itself with a slight dry cough, and grunting if made to move.

Amongst dairy-cattle, one of the first signs noticed may a lessening of the milk supply and a failing appetite, the animals being dull and not chewing the cud. Pregnant cows may abort. Later the breathing becomes more difficult and faster, the sick animal stands with its legs apart and the neck stretched out, and while at first it suffers from diarrhœa, later the bowels become constipated. If the beast is handled it shows signs of pain when the sides of the chest are pressed. In the last stages the animal loses all appetite, lies down and remains down, grunting and coughing, with the neck stretched out and dies from suffocation.

None of these symptoms are in themselves very diagnostic, but if there is reason to suspect that the cattle have been in contact with diseased cattle, or new cattle have been brought on to a farm which may have been in such contact and several beasts are attacked about the same time, they then become so.

If the lungs of a beast dead of pleuro-pneumonia are examined they are found to be partly solidified and larger than usual; the pleura covering the lung is usually thick and covered with a creamy exudate, and there is often a good deal of fluid in the chest cavity. If the lung is cut into it resembles marble with yellowish-white strands and lobules of different colours—some being reddish and others yellowish or greyish. From the cut surface a clear straw-coloured fluid oozes. The disease in its acute form lasts between two and four weeks, though some cases die in a few days. Very few animals ever completely recover, though some appear to do so, but may have small lesions in the lungs for a long time after apparent recovery, and so would be a source of danger to other cattle.

Treatment for this disease is useless; every infected animal should be killed, the remainder of the herd inoculated with "virus," and the premises where the cattle are put in strict quarantine. To take virus all the instruments required are a trocar and cannula and a clean pickle-bottle with an enamel funnel to fit into it, loosely covered with a piece of muslin for filtering. The bottle and funnel should be sterilised with boiling-water before use. Kill an animal which shows by its heaving flanks that it is in an advanced stage; bleed by cutting its throat high up; turn on its back and remove the abdominal viscera—bowels, stomach, &c.; and with a trocar and cannula puncture the diaphragm, withdraw the trocar and catch the virus in the bottle, filtering it through the muslin; cork and wrap up the bottle in cloths damped with cold water, keeping it as cool as possible until used. If the virus is thick, cloudy, or blood-stained it should not be used.

The safest point of inoculation is within about 3 inches from the tip of the tail. The threaded needle should be thrust through the soft tissue, not touching the bone, and withdrawn, leaving the thread in the tail. In about three to seven days a reaction may be looked for and the tails should be watched, as some may swell and become gangrenous, when they should be amputated close to the root.

Anthrax—Cumberland Disease.

This is an infectious disease due to a specific bacterium, the Anthrax bacillus. It is most commonly seen in cattle and sheep, but may attack any domesticated animal and man. The bacillus is found in the blood of animals dying from the disease. The disease may only attack one or two animals in a herd, or it may appear as an epizoötic, attacking large numbers of animals at the same time. It is often limited to certain farms, and even to certain paddocks on any one farm. The most important source of danger from this disease is the carcase of an animal that has died from it, for if the blood of such an animal is exposed to the air the bacilli are changed into what are known as spores, and as such are very resistant to heat and drying, and so may retain their vitality for a long time If any of these spores gain entrance to another animal they form bacilli, and the animal contracts the disease. The spores may be taken into the body with the food, or they may come in contact with scratches or wounds, and so gain the blood stream.

Symptoms in Cattle.—Usually no symptoms are observed, but the beast is found dead without any obvious cause. There is often a discharge of dark blood, which does not coagulate well, from the nostrils and anus, and as putrefaction takes place very rapidly in an anthrax carcase, the abdomen is usually very much distended with gas. Sometimes an animal, previously to all appearances in good health, suddenly drops down and dies in couvulsions.

Other cases show some premonitory symptoms, such as high fever, suspension of rumination and feeding, shivering, staring coat, dullness, and general weakness of the animal.

If the carcase is opened the blood is found to be very dark and tarry, and does not clot. The spleen is usually very much enlarged, and the stomach

and intestines may be inflamed, but otherwise there are no marked lesions. If it is suspected that a beast has died from anthrax it should not be opened, as it is dangerous, but burnt where it lies. If any sheds or bails have been in use they should be thoroughly disinfected, and the place quarantined. In cases of suspected anthrax, a drop of blood from the ear should be smeared on a thin glass slide and sent to this Department.

There is no possible treatment, but healthy animals may be vaccinated against anthrax.

Contagious Abortion.

This disease may be defined as an infectious catarrh of the womb, due to a specific bacterium. The first sign noticed by the owner of the cattle will be that one or more of his pregnant cows abort. Even the abortion of one cow is suspicious unless there is present some obvious cause acting to bring it about. This would be especially so had the cow been recently introduced from another herd, or been in contact with such a cow, or if she had been served by a bull recently introduced. If inquiry revealed the fact that contagious abortion was present, or had lately been present in the herd from which the cattle had been introduced, then the case should certainly be treated as one of contagious abortion. If the initial case is followed by several others, there will be little doubt that the abortion is contagious, and steps must be taken to minimise and suppress it.

Symptoms.—Contagious abortion may take the form of a temporary sterility, the animal taking the bull frequently, but failing to conceive. If conception takes place, abortion is usually deferred till the third or seventh month. There may be some heat and enlargement of the udder, or a decrease in milk-yield before the abortion, or a whitish-yellow dirty discharge from the vulva. In some cases the abortion is only discovered by finding the fœtus and its membranes. The membranes are, however, often retained, and become offensively putrid if not removed. The fœtus is usually born dead.

Treatment.—All cows which abort or show signs of approaching abortion should be isolated. The sheds and bails should be disinfected with a strong solution of crude carbolic acid or carbolic sheep-dip, and limewashed, to the limewash being added 5 per cent. carbolic acid or other disinfectant. All cows which have aborted should be treated, the vagina and womb being washed out with a pint of 1 in 5,000 mercuric iodide (three germicidal discs to a whiskey-bottle full of boiled water), or a 1 to 2 per cent. solution of lysol, or 1 in 1,250 mercuric chloride. To irrigate a cow take a piece of rubber tubing 3 feet long and ½ inch in diameter, with an enamel or glass funnel fixed at one end. Introduce the free end of the tube into the womb of a newly calved cow or the vagina of an in-calf cow, and slowly pour the disinfectant into the funnel. This washing should be repeated three times with a week's interval between each washing. The vulva, thighs, under part of the tail, and back of the udder should also be washed with the disinfectant solution.

Pregnant cows which may abort later should also have the hind parts and the vagina washed with the same solution.

One of the most important points in connection with the treatment of this disease is the disinfection of the bull, for it has been shown that a bull may become infected by serving an infected cow, and should he later serve a healthy cow he may transmit the disease to her. The outside of the sheath and abdomen of the bull should, therefore, be thoroughly washed with the disinfectant solution, and some should be injected into the sheath before and after allowing him to serve a cow. For this purpose an ordinary enema syringe may be used.

The fœtus of an aborted cow and the afterbirth should be at once burnt.

While the above measures will undoubtedly eliminate the disease from a herd they must be carried out thoroughly. No pregnant cow from an unknown source should be introduced into a herd without disinfection. The affected cows must be kept strictly isolated, and disinfection and lime-washing of sheds should be carried out every month.

Contagious Mammitis.

A contagious disease affecting the udders of milch cows, and due to a minute organism—a *streptococcus*. Although there are occasionally some general symptoms, such as a rise of temperature and a slight diarrhœa, the first sign that will probably be observed will be a change in the condition of the milk secretion, which diminishes in quantity, and, if left undisturbed, rapidly coagulates. In some cases the teat-duct becomes thickened, and a small, ring-like hardening is evident at the base of the teat; but this is not constant. Later, the milk may become watery and bluish in colour, while the hardening gradually invades the whole quarter; or it may become thick and creamy, yellowish-white in colour, and even clotted. Usually only one quarter is affected, but sometimes, if neglected, it gradually spreads to the whole udder.

Infection of healthy cows occurs from discharge on floors and woodwork of bails and sheds, and from the milkers' hands.

Curative treatment consists in the injection into the udder of some suitable disinfectant, such as ·4 per cent. boracic acid solution. About half a pint is injected into the quarter twice daily after milking, left in the udder for ten minutes, and then withdrawn. Or 3 per cent. hydrogen peroxide may be used in the same manner. The quarter should be well massaged with a little oil, and stripped as often as possible. Internally, beyond administering a purgative to the cow at the commencement of the case, little is necessary.

As a preventive to the spread of the disease, infected cows should be milked last, and the milk destroyed. Milkers should wash their hands in a little disinfectant after milking and handling them, and the bails should be limewashed and disinfected frequently. When possible, affected cows should be isolated from the rest of the herd.

Cancer.

This is a disease attacking cattle of all ages and breeds. It usually affects the skin and those parts covered with mucous membranes, such as the eye,

vulva, and anus. If noticed in the early stages, the growth may be removed with a knife; but, as a rule, cases are not observed until too far advanced to be operable. In such cases the affected animal should be destroyed. In the eye it shows as a small pinkish lump in one corner, which gradually enlarges until it may involve all the tissues surrounding the eye-ball, and which discharges from several points a dirty-white fœtid pus.

At the anus and vulva it shows as a gradually enlarging growth just beneath the skin, often involving it, and discharging from several points. On the skin, cancer most often develops from brand-scars, whence it may spread along the back and down the flanks as a hard, greyish, horny growth, bleeding readily on the slightest injury.

Blackleg.

An acute, infectious disease, due to a specific bacterium, and attacking principally young cattle between three months and one year old. Although this bacillus is the direct cause, other conditions will sometimes act as accessory causes, such as sudden changer of weather, chills, and debility. Once a pasture becomes infected, the disease may persist there for years. Infection usually occurs through wounds in the skin or mucous membranes of the mouth. The onset of the disease is very rapid, and the first symptom noticed may be a little lameness of one hind leg. If the animal is examined, swellings may be found on the quarter, thigh, shoulder, and neck, and occasionally on other parts of the body, but most commonly on the quarter or thigh, and the animal will probably be feverish. This swelling is at first small and tender, but it increases rapidly to a foot in diameter. The skin over it is dry, and when touched crackles. At this stage it is not painful, and if cut into the muscles underneath are found to be very dark and gorged with blood, and the liquid which flows out may be very black and sometimes frothy.

Besides these swellings, the only symptoms commonly observed are those of fever—that is, high temperature, loss of appetite and rumination, quickened breathing, and depression. Death usually occurs in twelve to forty-eight hours after symptoms are noticed.

The carcase quickly becomes inflated and frothy, liquid sometimes runs from the nose, mouth, and anus. If the swelling is cut into a little while after death, the muscles are discolored and will have a peculiar sour smell, and the lymphatic glands in the neighbourhood will be enlarged. But there are rarely any other *post-mortem* lesions except the presence of some fluid in the abdominal cavity, and inflammation of the stomach and intestines. The spleen is practically never enlarged, and the blood coagulates, thus differing from anthrax. Treatment is generally impossible, as the affected animals die very rapidly; but a good deal may be accomplished in the way of prevention, especially when the disease, as is often the case, appears to be localised in one paddock or part of a farm. If possible, this part should be brought under cultivation, and no longer used as pasturage, since the free turning up of the soil and exposure to sunlight destroys the germ. In the case of an outbreak, affected animals should be isolated, pens disinfected, and all carcases burnt.

The animals not affected may be inoculated with any of the reliable brands of blackleg vaccine; but this should be carried out under skilled supervision. These vaccines cause the animal to contract a mild attack of blackleg; and, since an animal that recovers from an attack of blackleg is protected against a second attack for the rest of its life, inoculation with such vaccines have been very successful in checking the disease.

White Scour and Lung Disease in Calves.

This highly contagious disease has been known for some time in dairying districts in this country, and has caused severe loss, and it is also very prevalent in other parts of the world. It affects calves of all breeds, and both those that are removed from the mother at once and those allowed to suck. The mortality is very heavy, ranging up to 80 per cent. It attacks calves two or three days after birth and proves fatal in a few days. Those cases that recover do so after a more or less lengthy period of intermittent diarrhœa. The symptoms, as given by the Chief Inspector of Stock, in his pamphlet on the disease, are as follow:—

"The constant sign of infection is a profuse diarrhœa. The dejections in the early stages are white with a slight tinge of yellow, and have an unpleasant odour. As the disease advances they become thin and frothy, and contain curds. Shortly before death supervenes a variable quantity of blood may be found mixed with the discharge. The act of scouring is often followed by severe straining so as to lead to protrusion of the mucous membrane of the rectum, which has an inflamed appearance. Associated with the scouring is abdominal pain, manifested by the calf moaning and crying out. Often the affected calf lies continuously on its side, with head turned round resting on its flank and shows a great disinclination to move. Presently the animal gnashes with its teeth, and saliva flows from the mouth. The hair is dry, dull, and ruffled; its eye dull, and the mucous membrane of the mouth pale. In the final stages of the disease the calf becomes extremely weak, so that it is unable to stand without assistance. The eye becomes duller and sinks in its orbit, the flanks tucked up, and the abdomen hollow. The nose is hot and dry, and a slight watery discharge flows from the nostrils. During the acute stage there is high fever and great thirst. In many cases the navel is enlarged and its vessels corded and painful when squeezed."

On *post-mortem* examination the umbilicus is found larger than normal, and under the scab there may be some pus; there may be a little abdominal congestion and hæmorrhage of the fourth stomach and intestines. Sometimes the fourth stomach contains masses of casein, and the contents of the bowels are liquid, frothy, and white, occasionally containing blood. The abdominal lymphatic glands are enlarged, and the liver and kidneys often congested, the former being slightly jaundiced. If the calves recover from white scour they may fall a victim to "Lung Disease"—the calf mopes by itself, appears dull, has no appetite, the coat being harsh and dry. Later there is evident fever, the nose is dry, breathing is hurried, and the animal emits a dry, painful cough. There is a copious discharge from the nose. The animal,

immediately before dying, lies stretched out on the ground panting violently. If a *post-mortem* examination is made the lungs are dark-red, showing the appearance of broncho-pneumonia, portions of the lung will be solid and may show abscesses containing pus-like material. Inflammation of the fourth stomach and intestines, as in white scour, may also be found.

Treatment of these affections is practically useless and need not be taken into consideration, but a great deal may be done to prevent the disease. On a farm on which the disease has appeared vigorous measures will be necessary to stamp it out and prevent a recurrence, as once pens and yards become contaminated they will remain so for a very long period, and they should be regarded as the chief source of danger. Therefore, new pens, built of fresh material, should be erected at some distance from the old ones, and when built they should be frequently limewashed and disinfected, and swept out every day while in use.

The cows, when possible, should just before calving be washed, as to the thighs, vulva, and tail, with a weak solution of lysol 2 per cent., or other disinfectants. As soon as the calf is born the cord should be tied with a ligature dipped in lysol solution, and the cord cut off below the ligature and the stump painted with tincture of iodine or 5 per cent. carbolised oil, and later coated with Stockholm tar. The calves should be fed from buckets, the buckets being scalded out with boiling water after every feeding, and the milk should not be kept in a wooden tub or barrel but in a metal receptacle, which can also be scalded out.

Affected calves must be isolated aud the carcases burnt. If there is any sign of white scour formalin should be given to the calves in the following strength : one ounce of formalin should be mixed with a pint and a half of water and one teaspoonful of the mixture added to the milk for each calf. If there has never been a case of white scour on a farm thorough cleanliness in feeding and housing will go a long way to preventing it.

Inflammation of the Eyes.

This may be due to cold draughts or the presence of a foreign body in the eye ; but is sometimes contagious and spreads rapidly through a herd. The animals affected mope by themselves, avoid the light, tears run from the eye, and the membranes round the eye are very much inflamed and painful, while the pupil of the eye becomes a light-bluish colour and sometimes ulcerates. In these cases the eyes should be washed twice a day with lukewarm water, and bathed with a solution of 1 ounce of boracic acid in $\frac{1}{2}$ pint of water. As it is probably spread by flies, a little castor oil or other agent may be painted round the eyes of healthy cows to keep them off.

If only one case occurs in a herd, and it is apparently not contagious, careful search should be made for a foreign body, such as a grass seed, and the eye bathed with warm water. Cows which are badly effected should be kept in a paddock by themselves, as they are very likely to be injured by other cows.

Ringworm in Calves.

Ringworm is a skin disease affecting cattle of all ages, but most commonly calves and yearlings, and especially those in poor condition. It is frequently found in calves which are poddied and kept confined in pens, and as it is very contagious, it spreads rapidly from calf to calf. It usually appears as round greyish-white patches, from which the hair falls off, and which are covered with a hard crust. These spread from the centre and may join in growing to a diameter of 2 inches or more. It is due to a fungus which invades the roots of the hair and causes them to fall out. It is easily cured by first washing the part with hot water in which a little washing soda is dissolved, and then putting on one of the following :—

Lard or vaseline 5 parts, sulphur 1 part.
" " 5 " iodine 1 "
Fish oil or linseed oil 5 parts, sulphur 1 part.
Tincture of iodine.

At the same time, the pens and sheds should be limewashed.

Calves kept in good condition, hygienic surroundings, and having a good run, are not likely to suffer from it.

(*To be continued.*)

The "Daily Telegraph" Farrar Scholarship.

Some months ago the Directors of the *Daily Telegraph* Newspaper Company (Limited) intimated their intention of donating an annual scholarship to the value of £10, to be competed for by students at the Wagga and Bathurst Experiment Farms, the successful student to take his second year at any of the agricultural schools—the Hawkesbury College or the Wagga or Bathurst Experiment Farms—provided he had already spent one year at one of those institutions. In the event of the fees for the second year's training being more than the amount of scholarship offered, the Minister of Agriculture agreed to forego that excess, in order that the scholar might enjoy the whole year's education free.

The first examination was held at the Bathurst Experiment Farm on 17th December last, seventeen students of that institution competing for the scholarship. The regulation provided that candidates were to submit themselves to a written and *viva voce* examination on "Cultivation of Wheat in New South Wales," and to submit a paper which had been prepared during their residence at the farm on Plant Breeding and results of observations amongst the stud and crossbred wheats growing on the farm. The examination resulted in Mr. R. G. Rennie, a student of the Bathurst Experiment Farm, being awarded the scholarship; Mr. E. K. Carroll, also a student of the Bathurst Farm, being placed second. The examination was conducted by Mr. G. L. Sutton, the Government Wheat Experimentalist, who expressed the opinion that the competition has been of considerable benefit to the candidates by causing them to make inquiries of the officers, and to obtain literature dealing with the subjects of examination.

HOUSEHOLD CAVALRY TYPE.

Fig. 1—English.

Fig. A.—Australian.

Army Remounts.

THE Board of Agriculture and Fisheries, England, have been supplied by the Assistant Director of Remounts, with the consent of the Army Council, with the following information as to the type of horses required for remount purposes in the Army, together with some photographs of typical animals :—

Age.—The limits of age for horses entering the Army as remounts in time of peace are between 4 and 7 years, and in time of war from 6 to 12 years.

Colour.—Whites and greys are only required for special purposes, and are always specially ordered. Other very light, or washy, coloured horses are not accepted.

Soundness.—Entire, unmanageable or vicious horses, crib-biters, wind-suckers, parrot-mouthed, or undershot horses, or horses with capped elbows, damaged knees, injured or deficient teeth, are not admissible.

Horses with short docks are not accepted.

Soundness in eyes, wind, and limb is essential ; no animals with worn, upright, or overshot joints, and none with curby hocks are passed.

The above conditions apply to all classes of remounts.

Household Cavalry.—Horses for the Household regiments must be well-bred, and at the same time able to carry weight. Their work being chiefly escort duty in London, a certain amount of action is necessary, and they must be good-looking animals. The price paid for these horses is considerably higher than that paid for the ordinary trooper.

The colour required is black, and height at 4 years 15·3 hands, and at 5 years 16 hands.

Fig. 1 shows a horse from the Royal Horse Guards. It is found difficult to mount the heavy men of this regiment, but this black gelding (6 years), standing 16 hands, has plenty of strength and quality for the job, moves well, and is fast.

Cavalry of the Line.—The class required is a deep, short-legged, short-backed, good-barrelled horse of the hunter stamp, with substance and quality, true action, and going without brushing the joints. Light, active, well-bred horses, that move truly and well in all their paces, well-ribbed up, with plenty of bone and short backs, may be said to represent the cavalry type.

Height at 4 years, 15·0½ to 15·2¼ hands ; over 4 years, 15·1½ to 15·2½ hands.

The number of cavalry horses required annually in normal times of peace is approximately 1,000.

Fig. 2 shows a young chestnut mare (5 years, 15·3 hands) from the 21st Lancers, well-bred, with plenty of bone. This animal is not looking its best in the photograph ; it wants time to furnish, and will look better in another year.

CAVALRY OF THE LINE.

Fig. 2—English Type.

Fig. B—Australian Type.

Royal Artillery.—The type required for the Artillery is the weight-carrying hunter, and as every horse, whether in the gun team or not, should be capable of taking its place there on emergency, the same type is preserved right through. For the Royal Horse Artillery, an animal with a little more quality and pace is required than for the Field Artillery.

Height at 4 years, 15·2 to 15·3 hands, and over 4 years, 15·2½ to 16 hands.

Fig. 6—Army Service Corps (English Type).

Fig. 3 shows a chestnut gelding from the Royal Horse Artillery, 15·3½ hands, 9 years old. This is a remarkably good-looking horse, fast, with a lot of quality and great scope.

Fig. 4 is a leader from the Royal Field Artillery, a bay gelding, 15·0½ hands, 13 years old. This horse can gallop, and looks as if he ought to have spent his life as a hunter; deep through the heart, with short legs, and the best of shoulders.

Fig. 5 is a Royal Field Artillery wheeler, bay mare, 15·2½ hands, 10 years old. This animal shows a nice bit of quality, with a good kind-looking head; the sort that would get her rider out of a difficulty if she possibly could.

ROYAL HORSE ARTILLERY.

Fig. 3—English Type.

Fig. C—Australian Type.

Royal Engineers and Army Service Corps.—Draught horses of the type known as the "Parcel Vanner" are required for these corps. They must be able to trot with a good load behind them, but they do not require so much pace as is needed in the Royal Artillery.

Height, Engineers, 15·2 to 15·3 hands at 4 years, and 15·2½ to 16 hands over 4 years; for the Army Service Corps, 15·2¼ to 15·3 hands at 4 years, and 15·2½ to 15·3½ hands over 4 years. The number of horses required annually in normal times of peace for the Royal Artillery, Royal Engineers, and the Army Service Corps is 1,360.

Fig. 6 represents a good stamp of slow draught horse for the Army Service Corps, a short-legged bay mare, 15·2 hands, 8 years old.

Mounted Infantry.—Mounted Infantry regiments are mounted on animals of the cob or galloway class; they require to be quick and active and able to gallop fast for a short distance. Height, 14·2 to 15·0½ hands, 5 years and over only. The height taken is over the standard for polo, so that there are plenty of animals of the stamp and quality required.

The number of horses required annually in peace for the Mounted Infantry is 140.

Fig. 7 shows a Mounted Infantry cob, 14·2½ hands, 12 years old. This animal has a nice short back and an intelligent head well put on, and looks wonderfully fresh on his legs, considering he has been in hard work for seven years without a day's rest.

There are no specified dates for the assembly and inspecting of horses. The Inspecting Officer of the Remount Staff is the final authority to decide on the purchase or rejection of any animal.

"Walers" as a Comparison.

M. A. O'CALLAGHAN.

What strikes one most in reviewing the recently-published information on this subject, is the fact of the *hunter type* being demanded right through the service with the exception of the draught horses required for the Army Service Corps and Royal Engineers. Let us see what is meant by hunter type. Judging by some of the horses that get prizes in hunting events in our show rings, the type does not appear to be too well understood. For a hunter, a man requires strength with galloping conformation as a minimum; if the hunter is to be anything more than a third-rater, he must also combine courage and intelligence in addition to the above. This is really the type of horse that any man riding over 12 stone wants when on any serious purpose, the type that in the early days of few fences and wild cattle the Australian stockman must have loved.

B

ROYAL FIELD ARTILLERY (LEADER).

Fig. 4—English Type.

Fig. D—Australian Type.

Good shoulders, short back, strong loins, good barrel, good bone of flat formation, an intelligent head, a sound set of feet, and smooth, even action —these are what go to make the hunting type—the type the polo player demands in his ponies, the artilleryman in his gunners, and so on. It has been customary in many of our shows to give the prizes for gunners to active draught horses, who, if forced to gallop for half a mile, would simply drop down. At the last Berry Show there were some beautiful types of gunners among the heavyweight hunters, but not one of them, I believe, was entered in the class for artillery horses. In judging these classes, it is always well to remember that a team usually consists of horses graded into three standards. The wheelers should be heavier than the centre horses, and the leaders not quite so heavy as the latter, but of undeniable heart and courage such as is evidenced in figure 4 (English illustration). There is little, if any, difference between the type demanded for heavy cavalry and that of leaders in gun teams. The shoulders of course may differ because whereas a gunner may have "harness" shoulders, the riding horse never should.

Quality and Thickness.

The English horse, bred on the same lines as the Australian, is almost always thicker and of bigger bone. Hence, from a photographic point of view especially, the average Australian remount horse will not appear to be able to carry weight as well as his cousin born in England or Ireland. Australian horses, however, have a toughness, a grittiness, and a heart which carry them on where the heavier horses often fail. One of the first things that struck me about the average utility horse driven and ridden in New South Wales was his ability to go long journeys without much fatigue. In this respect he surpasses most of his race. Unless this quality comes from heredity it is difficult to account for. No doubt in the early days of Australian settlement a horse was no use unless capable of performing long, tiring journeys, and thus by selection it is probable that Australian breeders have unconsciously developed an animal of staying powers far above the average. Another point which goes far in their favour is the free use of the thoroughbred sire, and the general absence of the coarse-boned, soft-hearted animal frequently called a roadster. I have driven many thousands of miles behind Australian horses, frequently on heavily-loaded coaches and over bad roads. I have always taken note of the teams before starting, and in almost every case where a good-sized horse of thoroughbred appearance is in evidence he outclasses his fellows before the journey's end is in view. Such horses only find their way into coach teams now, as a rule, because they have some bad blemish. I sat behind a team with such a one in it recently; a big, upstanding fellow, that appeared more suitable for steeplechasing than for coach work. At the end of the journey I inspected him pretty closely, having on the trip conjured up an idea of buying him, and, alas! a crooked foreleg revealed itself.

ROYAL FIELD ARTILLERY (WHEELER).

Fig. 5—English Type.

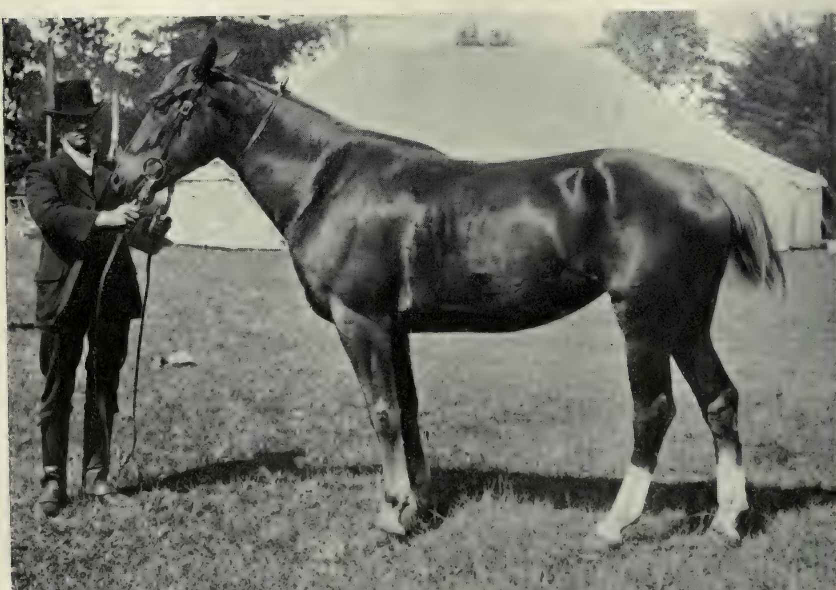


Fig. E—Second Prize Gunner at Berry.

Remounts at Berry Show.

In judging the hunters at the recently held National Show at Berry, I had an opportunity of seeing our Australian hunter type probably at its best. Certainly better and bolder jumping has seldom been seen in the show ring. A fine team of gunners could have been picked from amongst the heavy-weights, and cavalry horses of quality could have been found among the light-weights. Mounted-infantry types were lacking, but some were to be found among the hack classes The South Coast is not, however, the place to see the latter type; but in New England, the Upper Hunter, and other districts of New South Wales, the thick-set galloway, or big polo pony, is fairly common. It would appear advisable to have special classes in our shows for the very useful animal that comes in at mounted infantry height, viz., 14·2 to 15½ hands. If shown among the ordinary hunters he is generally outclassed, while the hack prizes are not valuable enough, as a rule, to bring such an animal out in any numbers. Such classes should not, however, be open to the professional show-ring hunter.

Fig. A is a powerful horse, with plenty of quality and breeding, suitable for cavalry of the Household type. He was exhibited in the hunting classes at the recent Berry Show. He is up to any weight; can gallop fast—for a short distance, at least. This animal was bred in New South Wales, and should be able to hold his own on a journey with the English horse shown in Fig. 1. His height is 15·3½, approximately.

Fig. B represents a good type of an Australian bred horse, suitable for cavalry purposes; he should compare very favourably with the English illustration Fig. 2. This animal is mainly thoroughbred, but also has a strain of the Arab in his pedigree, stands 15·2½ hands, and is a short-backed horse, active, and very powerful. He was a prize-winner in the hack classes at the Berry Show, and is the property of Mr. McCall, Wangaratta.

Fig C illustrates the well-known hunter, Fairfield II, his photograph having been taken at the Berry Show, where he was winner. He is a very powerful, massive animal, standing about 16 hands, and would make an excellent centre or leader for a gun team. For the purposes of comparison, he may be contrasted with Fig. 3 of Royal Horse Artillery type, English illustration. As the horse is seen here he may appear to lack depth in middle piece; but it must be remembered that his photograph was taken just after he had completed three severe rounds in a hunting contest, and he probably was empty so far as recent food and water were concerned.

Fig. D represents a game little horse, somewhat of the same stamp as the English illustration Fig. 4; he stands barely 15 hands 1 inch, and is very thick-set and powerful. He has spent part of his life as a stock horse and a hunter, carrying up to 15 stone, and I have seen him doing good work between the shafts of a dog-cart of some weight. He is about 12 years old. has done a lot of work, and appears capable of doing a lot more. Unfortunately he looked a bit sleepy as the photographer took him. He would make an excellent leader for a field artillery team, and was bred in the Macleay River district, New South Wales.

MOUNTED INFANTRY.

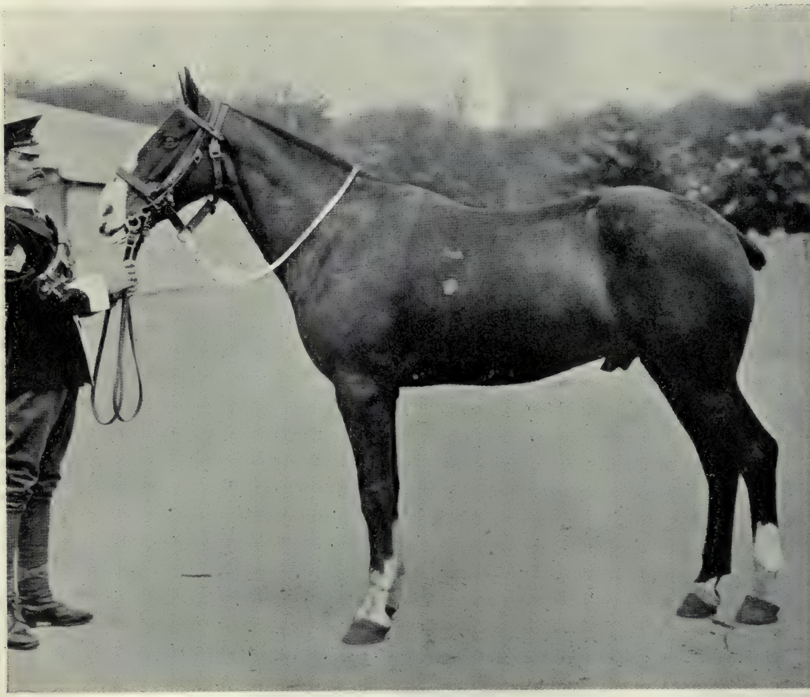


Fig. 7.—English Type.

Fig. F.—Australian Type.

Fig. E is rather a poor photograph of an active, powerful mare that obtained second prize in the gunner class at the recent Berry Show. Though not up to the standard of Fig. 5 (English illustration), she is, at the same time, a very useful class of animal, with sufficient strength and activity for a wheeler of a gun team.

Draught horses of the type suitable for Army Service Corps and Royal Engineers are fairly plentiful in New South Wales, but owing to the rapid agricultural development their price is probably too high to make New South Wales worthy of any note as a place in which to purchase these animals.

Fig. G—Mounted Infantry (Australian).

Another very excellent horse is illustrated in Fig. F. This horse, though of pony build, is a thoroughbred, standing at least 15 hands. He is one of the most powerful horses I have ever ridden, and has a reputation of being practically tireless. He was bred by the well-known breeders Messrs. Thompson in this State, and was recently a winner in the Cavalry and Mounted Infantry classes at the Tweed River Show. He compares well with Fig. 7.

Fig. G shows the type of thoroughbred pony more frequently met with in New South Wales than the stamp of Mounted Infantry cob or pony shown in English illustration, Fig. 7. Here there is more quality but less substance than in the English-bred animal; but this 14·2 mare can gallop very fast, is thick-set, and should be able to carry a good weight all day, as her advantage in breeding should give her heart and courage to keep going on.

Fig. H—Light Cavalry (Australian).

Fig. H illustrates the type of horse fairly common in New South Wales, namely, an animal almost thoroughbred, but a bit longer in the leg than is generally desired for remount purposes; still, animals of this class, though not up to as much weight as the thick-set beast, which is equally well-bred, are capable of doing very long journeys at a solid pace, and carrying a fair weight. This animal has extremely powerful hindquarters, and is of a light-weight hunter type. He was bred in the Bega district of New South Wales.

On some Plants which cause Inflammation or Irritation of the Skin.

A Warning:

(1.) The Poison Ivy (*Rhus radicans*) and its close relations.

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

Rhus radicans, L. "Poison, Climbing or Three-leaved Ivy"; "Poison Oak"; "Poison Creeper."

It is the *Rhus Toxicodendron* of American authors, in part, not L. [Let me emphasise the point that the *R. radicans* of which we are speaking is not synonymous with the true *R. Toxicodendron*, L.]

In the middle of January, 1903, while performing my ordinary duties in the Botanic Gardens, Sydney, I had occasion to go near our plant of Poison Ivy in the Gardens; I was not aware that I had touched it, and I do not think I did do so. It grows on a stone wall, out of reach of visitors. It occasionally requires pruning, and the pruner generally protects himself with leather gloves. In the course of years we have found some men immune to its effects, while others are sensitive. In fact, we cannot say, except as the result of experience, whether a man will be affected by it at all. Men are always warned about the plant, and the pruning is a voluntary act. A point I wish to emphasise is that I believe it is not necessary to touch this plant to produce evil effects; at certain seasons the poisonous principle is exhaled from the plant. The next morning my face was so swollen that I could not open my eyes. The itching torture I suffered I shall never forget as long as I live. My attention being thus emphatically drawn to the subject, I have never ceased to take an interest in it.

I wrote a paper, entitled "On Plants which induce Eczema," which was published in the *Transactions of the Therapeutical Society of London* (2nd Session), 1904. Although written by a layman, the medical men present listened to it with interest and courtesy, and commented on it favourably. I do not wish to obtrude on the domain of the medical men, but I do wish to earnestly bring this botanical matter before them and other citizens. Discussing the matter with my medical man, I found that but little was known about plant-irritants which induce the distressing complaint, of which I have spoken. Careful search on my part shows that the matter has largely escaped the attention of botanists also. In my paper I enumerated the plants producing skin irritation known to me, in botanical sequence, but the list is so scanty that no conclusion can be come to as the result of scanning

this list, except that at present the genus *Rhus* has unenviable notoriety. I will only deal with *Rhus* in the present paper, taking other plants subsequently.

Following is a Tasmanian case:—"Notes on a recent case of poisoning caused by the exhalation of *Rhus radicans* (*toxicodendron*) at the Botanical Gardens, Hobart." (F. Abbott in *Proc. Roy. Soc., Tas.*. 1886, 182.) Six men employed in the Garden were injured to a more or less serious extent. They were reducing the size of the plant on the 22nd September. Mr. Abbott's account is a very interesting one, and confirms our experience of it at the Sydney Botanic Gardens.

There is an excellent article on "The Poison Ivy—a dangerous plant," by the Earl of Annesley in the *Journal of the Royal Horticultural Society*, and a lengthy digest of it in *The Garden* of 14th March, 1903, p. 174. The irritating-producing nature of this plant is well described, a number of striking instances being cited.

There is an article entitled "Poison Ivy" in the *Kew Bulletin* for 1903, p. 15; but I did not see this paper till May, 1906, owing, I understand, to some delay in the publication. It is a reprint of a paper entitled "Ivy Poisoning and its treatment," by Franz Pfaff, M.D., Ph.D., of the Harvard Medical School, Boston, in *Rhodora* for March, 1902, pp. 43–45. He points out that the previous observations of J. Khittel, which attributed the active principle in *Rhus Toxicodendron* (*radicans*) and *R. venenata* to a volatile alkaloid, and those of J. M. Maisch to a volatile acid, are erroneous. Dr. Pfaff showed the active principle to be an oil, which he called Toxicodendrol.

It seems possible that poisoning might be caused by small particles of the plant, such as pollen and the hairs from the leaves, being carried through space by the wind, and thus brought in contact with the skin or clothing for, as above stated, the oil is contained in all parts of the plant, and even the hairs of the leaves may be seen under the microscope to contain oil.—(*Kew Bulletin, loc. cit.*)

Toxicodendrol is not a volatile oil, but on the contrary is very stable. Endeavour should be made to remove it as quickly as possible and prevent it spreading.

This can be done by vigorously washing the affected and exposed parts with soap and water and a scrubbing brush; that is to say, by mechanically removing the oil. As the active principle is very soluble in alcohol, other processes may be employed to remove the oil. The exposed parts may be washed repeatedly with fresh quantities of alcohol and a scrubbing brush. The poisonous oil may be thus removed in alcoholic solution. Another way of proceeding would be to wash the exposed parts with an alcoholic solution of lead acetate; in this case the poisonous principle would be first transformed in its insoluble lead compound and then washed away with alcohol.

The washing must be done thoroughly when alcohol is employed, as otherwise the alcohol might only serve to distribute the oil more widely over the skin. The finger nails should be cut short, and also perfectly cleaned with the scrubbing brush. Oily preparations, or anything which dissolves the poisonous oil, if used, should be immediately removed, as they may only spread the poison, giving it a larger area on which to work.

The treatment above outlined cannot cure the already inflamed parts, which must heal by the usual process of repair, but it does prevent the spreading of the inflammation and may serve to remove the poison before it has had time to produce its characteristic effects upon the skin.—*Kew Bulletin, loc. cit.*

This paper forms the basis of our present knowledge of the properties of this plant and of its antidote.

Then we have an excellent account of these plants known by V. K. Chesnut in "Thirty poisonous plants of the United States," *Farmers' Bulletin*, No. 86, of the United States Department of Agriculture, which I shall refer to later.

A valuable paper is, "Some constituents of the Poison Ivy Plant," S. F. Acree and W. A. Syme (*American Chemical Journal*, XXXVI, 301–321, September, 1906.) The authors recommend potassium permanganate as a cure.

The paper of Stevens and Warren, referred to under *R. vernix* (below) contains valuable observations in regard to the active principle of *R. radicans*.

Sir Ray Lankester, K.C.B., F.R.S., in his series of articles, "Science from an Easy Chair," wrote "A rival of the fabled Upas tree," in the London *Daily Telegraph*, of 14th August last, makes the following statement:—

A married couple, friends of my own, went to live about fourteen years ago, in a newly built detached house, standing in its own garden, in the neighbourhood of an English city. After they had been there two years the lady developed a very painful eruption or eczema on the face, which, in the course of a few weeks, caused the eyes, nose, and lips to swell to an extraordinary degree, accompanied by the formation of blisters and breaking of the skin. The affection spread to the body, and caused constant pain and corresponding prostration. Her medical attendants were unable either to cure or to account for her condition. After some months she left home and entirely recovered. But every year the same distressing and disfiguring illness attacked her (commencing in the month of June), and disappeared as soon as she left her house, only to return when she came back to it. The doctors spoke of her affliction as a mysterious form of erysipelas, and even suggested blood-poisoning as the cause. For long periods she was so ill, and in so much pain, that she was unable to see her friends, and her life was at times in danger.

Last December a weekly newspaper published an account, written by a correspondent, of an illness from which he had suffered—exactly agreeing with that which had for so many years tortured my friend's wife. This writer stated that he had ascertained that the disease was due to the action of a poison given off by a creeper which grew on the walls of his house. He had supposed this plant to be a Virginian creeper, but he had discovered that it was in reality the Californian Poison Vine, called by botanists, *Rhus toxicodendron*. The terribly poisonous nature of this plant is well known to the people of the United States. It is one of the Sumach trees, of which other poisonous kinds are known, whilst more than one species is used for preparing a resinous varnish, which is used in the manufacture of "lacquered" articles. The writer in the weekly paper stated that he had cut down and burnt the poison vine which grew on the walls of his house, and that his sufferings had ceased. My friend happened to read this account, and immediately examined his own house. He found a creeper resembling a Virginian creeper, but having three leaflets or divisions of the leaf instead of five, growing around his drawing-room window, and actually spreading its branches and leaves over the window of his wife's bed-room. He sent specimens of the creeper to Kew, where it was at once identified as the *Rhus toxicodendron*, or American Poison Vine or Poison Ivy. He caused the plant to be removed and burnt, and, except for a slight attack in July, due, no doubt, to fragments of the leaves still carried about in the form of dust, his wife has recovered her health.

A few weeks ago a well-known professional man living in a Sydney suburb, called on me in regard to some climbers that had been planted on

his house. In response to my request, he wrote to me as follows in regard to a very serious case :—

As stated to you, my wife has suffered from being poisoned by the *Rhus* for the past 4½ years. The symptoms detailed by Sir Ray Lankester are identical so far as mere description goes with those of my wife's illness, but far from being exaggerated these do not give any idea of the horrible and terribly distressing effect of the poison and the suffering caused by it in her case, and the treatment by different medical men gave her no relief.

I know of several other similar cases which were traced to this creeper, and will endeavour to get you particulars if you think it necessary. My wife had satisfied herself that her illness was due to this plant some six months ago, but it was not until these paper cuttings were sent out that we had any idea what the plant was, and as you are aware I then saw you when you identified it. I sincerely hope that your publication of the particulars will lead to the extermination of this dreadful plant, and prevent other people suffering from its effects.

To what extent people have been injured in Australia by this plant I have no means of knowing, but I find that there are some plants of *Rhus radicans* in the country districts of New South Wales, as well as Sydney, which have caused a good deal of suffering of a mysterious nature, and I am receiving a good many letters on the subject.

As the plant, usually under the name of *Rhus toxicodendron* is in some catalogues of nurserymen, I give the most solemn warning on the subject, and express the hope that, except in public gardens, where it may be under the strictest control for educational purposes, it may be carefully destroyed. No nurseryman or private individual ought to possess it ; it is too dangerous.

The danger is that this plant is sold as a Virginia Creeper or *Ampelopsis* (*Hoggii*), not as a *Rhus*, which latter name would cause suspicion in the minds of many educated people.

Then it is sent out as a small plant, and is not handled much until it gets to be a big one, and has to be cut away and otherwise kept in bounds. Then the trouble begins. This takes a few years usually at least !

It is similar to keeping a pretty little tiger cub as a pet. All goes well till he gets big.

In the Botanic Gardens, Sydney, we use carbonate of soda or washing soda as a remedy ; it gives immediate temporary relief.

The poison is destroyed, as Pfaff has shown, by an alcoholic solution of acetate of lead (sugar of lead). It is recommended not to use strong alcohol, but alcohol of 50 to 75 per cent. To this the powdered sugar of lead is added until no more will easily dissolve. The milky fluid should then be well rubbed into the affected skin. The itching is at once relieved, and the further spread of the eruption is checked. The remedy has been tried in a large number of cases and has always proved successful."

Acree and Syme recommend potassium permanganate. But I strongly recommend that the following advice of Chesnut be taken :—

It is highly desirable that legal measures be adopted compelling the destruction of these plants where they abound in cities and in places of popular resort. This can be managed without much danger from the poison, and is a matter of very general interest. As has already been noted, many individuals are practically immune from the effects of

Poison Ivy. Advantage should be taken of this fact to employ such individuals to remove these plants from the vicinity of dwellings and from playgrounds. Much of the work would be purely mechanical, consisting in rooting the plants up by main force. This is the most certain method ; the use of concentrated sulphuric acid is attended with less danger, as the plants do not need to be touched. A half teaspoonful should be applied to the stem every two or three weeks in the spring time when the plant is growing most vigorously. Care should be taken to keep the acid away from the skin, as it is most highly corrosive. The brush should, in no case, be left upon the ground nor the wood used for fuel. In burning the refuse in the field, pains should be taken not to inhale the smoke, nor to handle the wood any more than necessary.

The greatest care should be exercised in preventing workmen from transferring the oil from their clothes and hands to other individuals. To accomplish this object special suits should be worn, and the hands should be washed several times a day with the alcoholic sugar of lead solution described above. Bathing in hot water with strong soapsuds is recommended. The clothing must also be well washed, and it is always well to remember that towels may be a means of conveying the oil.

Chesnut is writing in the United States for United States readers, and he knows perfectly well he cannot entirely eradicate these plants in that country, where they are so abundant. But I believe we can entirely extertermainate them in New South Wales.

Confusion with Ampelopsis, or Virginia Creeper.

I do not think that *Rhus radicans* and *Ampelopsis Veitchii* present a close resemblance, but they are, undoubtedly, confused, particularly when in the leafless state, so I submit the two photographs of plants in this garden.

Other Poisonous Species of Rhus.

(1.) *R. diversiloba*, Torr. and Gr. "Poison Oak," "Poison Ivy," "Yeara," "California Poison Sumac."

The "Poison Oak" is usually a small shrub from 2 to 5 feet high, but, occasionally, it ascends the trunks of trees as a vine to a height of 15 or 20 feet. The leaflets are orbicular to ovate, glaucous, with distinct venation. They contain an irritating and poisonous volatile oil, which poisons many persons by simple contact, or even by diffusion in the air.

R. diversiloba is everywhere common through the hilly portions of California.

(2.) *R. metopium*, L. "Poison Wood," "Hog Gum."

Figured by Sargent, tt. c, ci.

A tree of 35 to 40 feet. "The juices of *R. metopium*, and even its exhalations at the time the trees are in flower, are exceedingly poisonous to most people, producing the same symptoms as those caused by *R. Toxicodendron*."—Sargent.

(3.) *R. Vernix*, L. "Poison Dogwood," "Poison Sumach."

Figured by Sargent, tt. cvii, cviii.

A small tree with acrid poisonous juice, turning black on exposure. "One of the most dangerous plants of the North American flora. The juices and the effluvium from the flowers possess the properties found in those of *R. metopium* and *R. Toxicodendron*, and to most people are even more injurious."—Sargent.

"Poison Sumac," by A. B. Stevens and L. E. Warren, *The American Journal of Pharmacy*, vol. 79, 499–522 (November, 1907).

A valuable research into the properties of *R. Vernix*, L. (*R. venanata*, DC.), a specially good paper.

"Swamp Sumac," "Dogwood," "Poison Dogwood," "Poison Elder."

(4.) *R. vernicifera*, DC. The Lacquer Tree of China and Japan. Its milky juice is acrid and poisonous. The juice is so dangerous that its nature is not as yet fully understood.

(5.) *R. Cotinus*. The "Wig-tree," as well as *R. Conaria*, which are both natives of the Mediterranean region, are looked upon with suspicion in the south of Europe. The latter plant is unquestionably dangerous, and produces an erysipelas-like affection of the skin of persons who gather the leaves for the sake of the tannin they contain. (*Gardeners' Chronicle*, 8th August, 1908, p. 10.)

A. *Rhus radicans*, L. **Poison Ivy**

B. *Ampelopsis Veitchii.* **Virginia Creeper.**

EXPLANATION OF PLATES.

A. *Poison Ivy.*—The size of the terminal leaf is from 6 to 8 inches long by 4 inches broad. The common dimensions of the side or smaller leaves are $5\frac{1}{2}$ by $2\frac{1}{2}$ inches. Note that the leaves are compound—that is to say, composed of a number of individual leaflets.

B. A so-called Virginia Creeper (*Ampelopsis Veitchii*). Quite harmless. A close relation of the grape-vine. Its leaves are (say) 4 inches by 4 inches.

This class of leaf is simple, *i.e.*, however deeply its divisions may be, these cannot be separated from each other without tearing.

N.B.—This is the chief and an infallible point of difference between a Virginia Creeper and a Poison Ivy.

A PAIR OF VETERAN CHAMPIONS.

Jersey Cow—Lady Tidy 3rd (imp.).
Born 21/3/1894. Nearly 15 years old.

Kerry Cow—Belvedere Bratha (imp.).
Born 5/3/1895.

Cattle at Berry National Show.

M. A. O'CALLAGHAN, Dairy Expert.

THE Berry National Show resulted in an excellent display of dairy cattle, and although some exhibitors, such as Mr. George Tait, of Kangaroo Valley, were missing, their places were taken by new men, and all breeds of cattle

Fig. 1. G. W. Eaton's Jersey Bull—Cherry's Pride 2nd.

were excellently represented. The most noted amongst those who had exhibited at Berry for the first time was Mr. George Eaton, the well-known Jersey breeder, and the result was a great duel between him and the local talent as represented by Mr. David Hyam.

In the accompanying illustrations are seen some of the Jerseys, Fig. 1 being Mr. Eaton's champion bull, and Fig. 2 the well-known Government bull, Sir Jack. As usual at South Coast shows, the Shorthorn type of cattle exhibited both as dairy shorthorns and in a separate class as dairy cattle dominated all others, and the interest in them does not appear to flag

Fig. 2. Government Jersey Bull—Sir Jack (not competing).

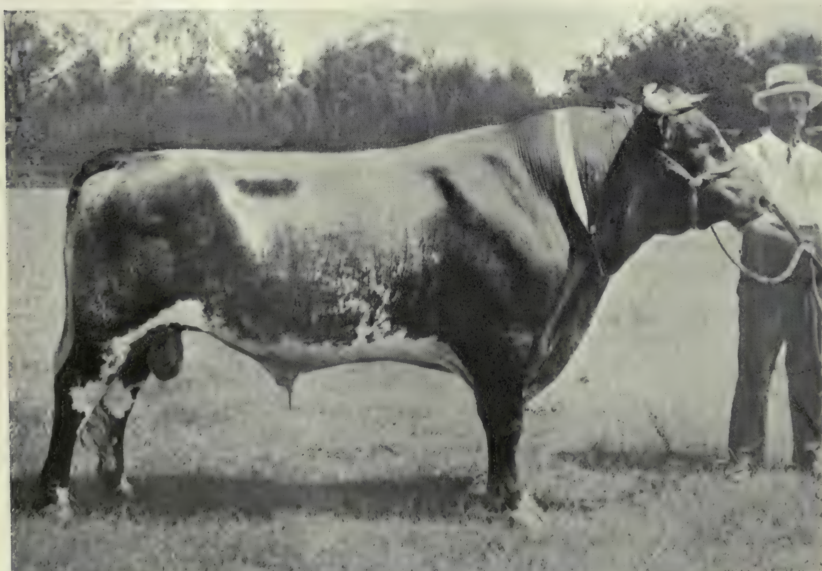


Fig. 3. Shorthorn Bull—The Admiral.

in any way. The champion Shorthorn bull turned out to be a grandson of the imported bull Clipper, introduced into New South Wales by the Department of Agriculture. Clipper was the sire of Skipper, Mr. Morton's great bull, and Skipper sired the winner on this occasion, named Admiral, whose photograph is given. (Fig. 3.)

Ayrshires, thanks to the Coolangatta Estate and Messrs. Lamond and Lindsay Brothers, were well represented both in class and numbers, and to this breed fell the group prize open to any breed, and which, to a certain extent, is looked upon as the champion award of the show among dairy cattle, Dr. Hay's group having secured the honors on this occasion.

I have seen the class better represented in the males, but the females were quite as good as any I have seen at Berry Show, and amongst them

Fig. 4. Government Exhibit—Guernsey Cow and Heifer.
Exhibited (not competing) at Berry.

was a very promising three-year old, the property of Sir John Hay, whose photograph is given herewith, viz., Blonde of Coolangatta (Fig. 5). Underneath is seen the handsome young cow (Fig. 6) Primula, a daughter of the noted cow Miss Prim, the property of the New South Wales Government.

Holsteins.—Although this class was well represented in quality there was little interest displayed, as Mr. Lamond had the competition to himself. His bull, Edinglassie, was in good show trim, and it was thought by many that the Holstein group would pull off the prize above referred to as having been won by the Coolangatta group of Ayrshires. It is surprising that the Holstein breed does not catch on much better in New South Wales, because, as a cross to produce heavy milkers, there is none better. No doubt the recent droughty seasons which we have had on the South Coast of New South Wales have, to a certain extent, prevented this

Fig. 5. Ayrshire Heifer—Blonde of Coolangatta.

Fig. 6. Government Ayrshire Cow—Primula (not competing).

breed from obtaining greater popularity. Butter makers, as a rule, are shy of this breed, because of the general opinion that they produce too little butter-fat to be profitable, but whereas, to a certain extent, this is true of purebreds, the crossbred Holsteins come out fairly well in butter-fat, but fall away in solids not fat compared with some other breeds. Last week the Holsteins at the Berry Stud Farm yielded milk which tested in the morning 3·27 per cent. of fat and in the evening 3·72 per cent. of fat, while the solids not fat were 8·59 per cent. in the morning and in the evening 8·25 per cent.

Fig. 7. Messrs. Kinross Bros.' Guernsey Bull—Prince of Peace.

Guernseys, the popular breed of the Northern Rivers, and what promises to be the popular breed of New South Wales, were represented at the Berry Show, but, numerically, the representation was weak. On the other hand, however, a couple of excellent specimens were exhibited by Messrs. Kinross Brothers, of Jamberoo. Their bull, which easily obtained first in his class, was bred at the Government Stud Farm, Berry, and is full brother to the bull at present used at the Stud Farm, namely, Calm Prince, being a descendant of that noted imported bull Rose Prince. Among females, their young cow supported the character of the breed excellently. Her photograph is given in Fig. 8, and speaks for itself, as far as type and robust constitution are concerned. She was bred by Mr. Dixon Cooke, at Alstonville, and is the descendant of recently imported blood on both sides.

Monsieur Beaucaire. Star Prince.

Fig. 9. Berry Stud Farm Exhibit—Two Young Guernsey Bulls.

State Representation.—The Berry Stud Farm made a representative exhibit at the National Show, as is evidenced by the illustrations of some animals which are facing the opening page. Two old cows, imported over ten years ago, were exhibited for the purpose of showing type, more especially to demonstrate the robustness and hardiness of constitution which these must have possessed in order to look as well as they do at present, considering that they were four years old when imported in July, 1898. One is the noted Jersey cow Lady Tidy the Third, and if anything would aid to dispel the

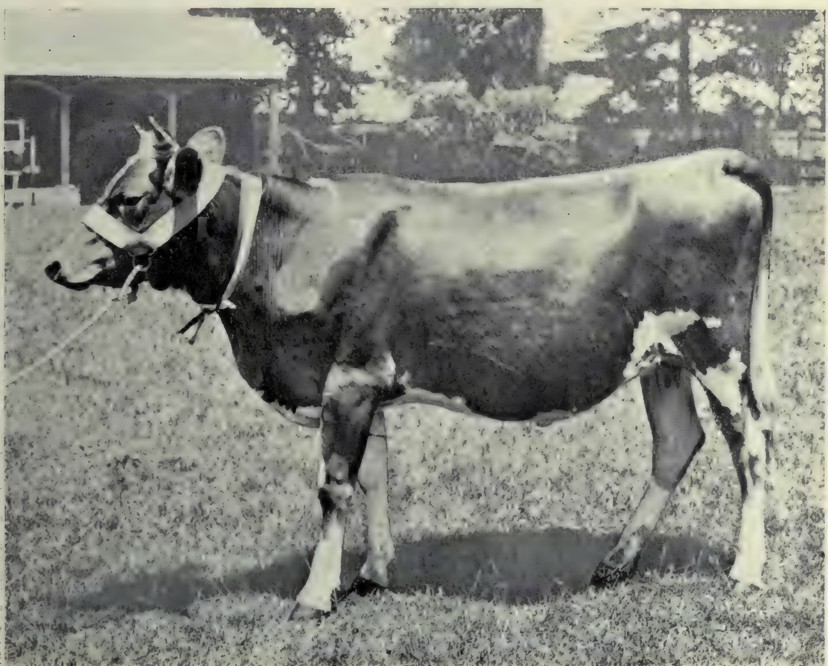


Fig. 8. Guernsey Heifer, the property of Messrs. Kinross Bros.

ideas prominent in the minds of a good many farmers that the Jersey is a delicate animal, this cow and her mates of the Jersey importation should succeed in doing so. The other cow referred to is that great producer Belvedere Bratha the Third, one of the finest specimens of the Kerry breed that was ever milked, and an animal that beat all others of all breeds on the Stud Farm during a year of fairly severe drought. She yielded that season 8,311 lb. of milk, or 442 lb. of butter.

The Guernseys illustrated are two young cows (Fig. 4) bred at Berry and two young bulls (Fig. 9). They are all of the robust vigorous type.

Artificial Incubation.

G. BRADSHAW.

Introduction.

ARTIFICIAL incubation, although only brought into profitable practice in English speaking countries within recent years, was in operation in the early days of human history.

In Egypt, before even the Pyramids were built, historians tell us of the rude but efficient structures that the inhabitants of the Delta of the Nile employed in hatching eggs. The incubators were huge ovens of earth or clay, termed mamals, heated by dried cowdung, &c. To these places the Egyptian peasants brought their eggs where they were hatched for a small fee. The fire was underneath, the heat being controlled by a system of flues and dampers; and although mechanical contrivances for measuring temperatures were then unknown, the heat was completely under the control of the dusky operator. His bare hand being thrust into the egg chamber was the infallible instrument to guage the heat, and it is said an underheated or overheated egg was unknown.

The incubators were institutions for the general public, and the success was such that it was nothing unusual for a chicken to be delivered for every egg received.

Sir John Mandeville, an old English traveller of over 500 years ago, in his writings gives an account of the Egyptian incubators at that time as follows:—

> And there is a common house in that city that is full of small furnaces, and hither bring women of the town their eyren—eggs—of hens, of geese, and of ducks for to be put into those furnaces.
>
> And they that keep that house cover them with heat of horsedung without heat of hen, goose, or duck, or any other fowl.
>
> And at the end of three weeks or of a month they come again and take their chicks and nourish them and bring them forth, so that all the country is full of them.
>
> And so do men there, both winter and summer.

The land of the Pharaohs was, however, not the only one in ancient days to improve upon nature in reproducing fowls. China had also methods, crude to our notions, but efficient withal, which have been described by a traveller as follows:—

> The building is merely a straw-thatched shed, at the side, generally, of a cottage. Straw baskets are ranged along the ends and one side of the shed and plastered with clay to render them incombustible, and a till forms the bottom, beneath which a small fire burns. A straw cover is placed over each basket during the process. In the centre are wide shelves over each other, to receive the eggs, at a certain stage of the operation. These being placed in the baskets, a fire is lighted, and a steady heat between 95 and 102 degrees, but regulated by no better thermometer than the sensations of the attendant, is kept up. As in the Egyptian process, the eggs are taken up, after undergoing for a few days the first heating process, one by one, and the infertile ones rejected. After nine or ten days more, the fertile eggs are removed from the baskets and spread on

shelves covered up with cotton or some similar substance, but without fire underneath, and thus they remain during fourteen days more, when the ducklings burst their shells; and in two days afterwards they are sold and carried off.

The few writers who have actually seen the Egyptian and Chinese hatching operations, although differing in small descriptive matter, all agree as to the effectiveness of both. These old time operators claimed immunity from failure; but whether or not, all the evidence goes to show that despite the absence of mechanical appliances, hatching in those days was satisfactory, a term which can scarcely be given to the work from some of our own modern devices, for while every known machine has occasionally given the maximum of results, poor hatches have been so frequent as to seriously discount the efficiency of the incubator as a profitable adjunct to the poultry yard.

That these failures are due to other causes than the incubator is the purport of this and following articles to show, the writer's belief being that of a well-known American experimenter, Dr. H. P. Nottage, Goshen, Mass., who lately wrote:—"Wonderful progress has been made in artificial hatching. Incubators are not yet fool proof, but they are pretty near to that point."

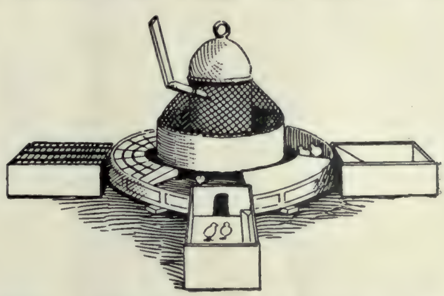
Early Incubators.

The first European attempt at artificial incubation was that tried at Amboise, France, by Charles VIII, at the end of the fifteenth century. It was the Egyptian method, and it is on record that while a few chickens were actually produced in several attempts, the trials were pronounced failures and given up.

At the end of the sixteenth century, in the time of Francis I, the same system was employed, and with more success, as is evidenced by the following extract from an old work:—

Paid to Messer. Nicolas Vigens, an Italian, employed in working an oven for hatching and rearing chickens without hens, which he has done for the king's pleasure, at the rate of 4 sols 2 deniers per day, and has been paid, as appears by this receipt, the sum of 58 sols 4 deniers.

Réaumur, the naturalist, who invented the thermometer bearing his name, came next, about 1740, and, in addition to propounding a method of preserving eggs, hatched chickens in casks surrounded by dung. He improved by putting the eggs in drawers over a baker's oven, and, later on, he substituted hot water instead of the dry heat, and got fair results.



Réaumur's Hatching and Rearing Apparatus, about 1740.
From an old work.

Perhaps the first English trial at hatching eggs by artificial means was the successful attempt by the author of Moubray's "Domestic Poultry," while residing in Surrey, in 1782. His methods were not divulged, but he says:—

Although satisfied with the success in hatching a considerable number of eggs, there was no adequate motive to pursue it in this country (England), where a quantity of poultry fully equal to the demand may be raised by the natural means. Were it otherwise, the

artificial process might be conducted with sufficient success in the multiplication of domestic fowls. No person will now attempt artificial hatching but from a motive of mere curiosity, and that motive must be indeed powerful to carry one through the labour and attendance required.

In 1823, attempts were made in London, Bath, and other places, but with no practical results, as previously stated, there being plenty of fowls for the then demand.

About 1846, a Mr. Cantelo successfully brought out a machine differing from all the previous constructions in two important points. First, the degree of heat to which the eggs were subjected was much higher than in the Egyptian or Chinese ovens. Cantelo asserted blood heat was near 106, and at this standard, as near as possible, he kept. Second, the heat, which in the older system had been either around or underneath the eggs, was now placed on top. Not in a tank, as with incubators of to-day, but by a stream of hot water flowing over the chamber wherein the eggs were placed. Mr. Cantelo named his machine the "Hydro incubator," and had shilling exhibitions of it in London and the provinces.

As showing the then general indifference to the new methods, a writer in one of the English papers at the time said :—

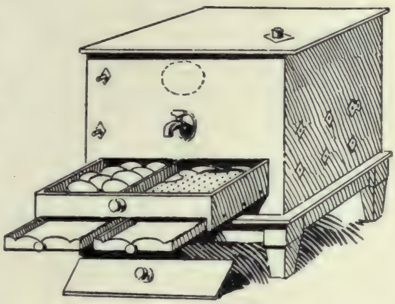
> The incubator almost infallibly hatches every good egg entrusted to it, but (and that is everything) the machine will neither feed nor rear the young when produced, and their exit from the world is rather more rapid than their entrance.

For the twenty years following the above period, while the same opinions and much indifference prevailed as to the practicability of the new system of bringing forth life, there lived in Dublin a great aviculturist, J. J. Nolan, who heard of Cantelo's work, and visited his artificial hatching and rearing establishment. He describes the place as follows, and although sixty years have expired since then, it might apply to any present day modern poultry plant :—

> Having occasion to visit the great city of centralisation, overgrown wealth, and extreme poverty, I was driven out by a friend to Chiswick to see Mr. Cantelo's "Hydro incubator," or egg-hatching and poultry rearing establishment, and must confess, though I had no previous faith in it, it astonished me to see, at an inclement season, chickens of all ages from just emerging from the shell to that of being ready for the table, and most singular, each in perfect health—no drooping of wings, no moping in corners, no pip or roup—in fact, no disease to which poultry flesh is heir to. A lot of chickens, in large or small quantities, in such rude health I have never seen ; and there has been reared up in one building, and at one time, upwards of 1,300, all to be disposed of from the London poulterers' shelves, and still not equal to the demand. The advantages are many in comparison to hatching by the hen. In the first place, they have no hen to devour their dainty food, such as chopped egg and oatmeal ; they have no hen to drag them through the ditches or trample them to death ; and have no larger chickens to peck at them. They have their artificial mother, kept up to the temperature of the natural mother, and it is beyond conception how they will adhere to the warmth of the mother prepared for them, and run in under the woollen cloth as if it was natural to them. Each age has its separate compartment, with an opportunity, in fine weather, of passing out to a grass plot, and you will see them enjoying themselves in the open air, and, when at all chilled, returning to the artificial mother and making themselves perfectly comfortable. The hatching apparatus is kept up to 106 degrees, and is padded with india rubber ; the eggs are placed in a tray with a perforated bottom, and laid on a woollen cloth and raised to come in contact with the rubber, which sinks and covers the egg as much as the natural mother is supposed to do ; thus nature is represented as nearly as possible. After incubation, the artificial mother consists of a number of heated pipes about an inch and a quarter in diameter, and about the same distance apart, resting on supports about 5 inches from the floor. Beneath these pipes is a sliding board, which is always at such a height as to allow the backs of the chickens to touch the pipes, and is gradually lowered

as they increase in size. This board is removed and cleaned every day, or replaced by another which had served the day before, and had been cleaned and aired during the twenty-four hours preceding. Above the pipes (about an inch) is another board similar to that below, from which descends a curtain in front of the mother. This board serves the double purpose of economising the warmth and preventing the chickens dirtying each other, as they are fond of jumping on the mother if not prevented. The young chickens having been once placed beneath this mother will only leave it to eat, drink, and exercise, and return to it of their own accord. The patentee, Mr. Candelo, has had equal success in rearing turkeys, pea, and guinea fowls ; and although I have seen ducks in all quarters of Great Britain, I have never seen, in one lot, so fine a collection as those produced by the "Hydro incubator."

For a number of years following the above date, there were occasional attempts at improving and popularising hatching machines, but through expensiveness or other shortcoming, none of them found favour until the Dairy Show at the Agricultural Hall, London, in 1877, when Mr. T. Christy exhibited a machine called the Hydro incubator. This machine was most simple in construction, and immediately made many friends, and was the means of, for the first time, seriously directing the attention of British poultry men to artificial methods. Indeed its success was such that its fame soon reached these shores, and a couple of years after its invention it was publicly advertised by Messrs. F. Lassetter & Company in the Sydney papers. The machine consisted of a hot-water tank divided into sections, from which 2 gallons of hot water were drawn off twice in every twenty-four hours, to be replaced with the same quantity of boiling water, thus keeping up the temperature. Under the tank was the egg drawer, provided with arrangement for damping, and apertures for ventilation, the whole being surrounded by non-conducting material. There was a thermometer in the tank and another in the egg-drawer, nothing else.



Christy's "Hydro."
The first incubator introduced to Sydney, 1879.

Lewis Wright, in his 1885 edition, says :—

That when so many had devoted money, pains, and complicated apparatus to keep up a regular supply of heat, a machine should succeed, which depended altogether upon a re-supply of boiling water every twelve hours, appeared to all simply ridiculous. The following year, however, a competition of incubators took place at a poultry show at Hemel Hempstead, at which this incubator far outstripped all competitors ; and the success then obtained, so far from being accidental or temporary, was much surpassed on other occasions. The earlier machines were, in fact, somewhat defective in ventilation and other matters ; but as improvements were made in these, the simple Hydro incubators were sold literally by hundreds, and solved the long sought problem, by making artificial hatching a practical reality.

The Hydro was but a short time in the field till other incubators arrived, particularly that invented by a Mr. Thomlinson, an English poultry fancier, which for a time was popular. Following this came a second one from Christy, named the Thermostat, which was worked by the heat of a lamp under a circulating boiler, with the additional improvement of a Thermostat bar to regulate the temperature.

The above machines and a number of others had all some favourable feature, each one being an improvement on its predecessor; but still the bulk of them failed in generating and maintaining a uniformity of heat during the three weeks' hatching period, and this left the way open for a machine that would be actually automatic in working. To attain this essential, many ingenious devices were introduced. Experience, however, contradicted their claims for effectiveness until Charles Hearson, in 1881, launched on the poultry world his discovery of an appliance which fulfilled all reasonable expectations in the way of governing the heat in the egg chamber. He patented his regulating device and incubator in 1881, the main principle of which machine, and time to time improvements, have been adopted by almost every incubator manufacturer to the present day, and in the interim over 300 different English makes have been on the market, about one-fourth of that number still competing for, and sharing in, public favour.

Previous to the Hearson invention, the great difficulty to overcome was the maintenance of an even temperature in the egg drawer in spite of the fluctuations in the heat supply and atmosphere. Hearson knew that certain liquids have fixed boiling points: water, 212; ether, 35; alcohol, 173; sulphurous acid, 640, &c. A proportion of two or more of these can be mixed, the boiling point of which would be (say) 100 degrees, the vapour then occupying many times the space it would when in a cool state. Mr. Hearson conceived the idea of two round brass pliable discs, soldered together at the edge, enclosed some drops of the prepared liquid which, when it boiled, would expand the capsule. It was then but a matter of contriving a plan whereby this capsule could be suspended in the egg chamber and connected in some way with the heat supply, so that when 106 or other dangerous degree was reached, the liquid boiled, the capsule expanded, and thus acted on the heat supply, either by cutting off the lamp flame or directing the heat outside the incubator, when the normal conditions would soon obtain. The satisfactory settlement of the application and regulation of the heat practically completed the sum and substance of the hatching machine, the other features—moisture and ventilation—being matters of detail which the manufacturers each determined to their own and the bulk of their clients' satisfaction.

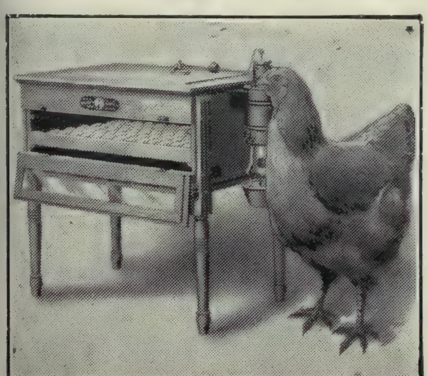
Hearson's excepted, English made machines never became popular in Australia. Occasional importations of other makes arrived, but failed to give satisfaction. The handicap to Hearson's was its expensiveness.

In 1886 the writer operated one of this make on a poultry farm near Liverpool of a 300-egg capacity, which, with freight and other charges, cost within a few shillings of £30. The patent of this incubator expired a few years ago, enabling it to be landed here at a moderate cost. However, by that time the Americans had secured a considerable portion of the incubator trade, the balance of it going to and continuing with those of our own manufacture.

American Incubators.

Although in Europe several fairly successful attempts at hatching chickens by other means than hens had been made prior to 1850, it was not till twenty years afterwards that artificial hatching methods received any attention in America. In an issue of the *Poultry World* in 1876, mention is made of an incubator made in Boston. In 1878 the same paper gave illustrations of the "latest invention, the perfect hatcher, the only reliable hatcher in the world except the hen, 100 per cent. having been obtained by our customers last season." It was manufactured at Elmira, New York. Following this, new ones were of frequent appearance until 1881, the year of Hearson's invention. The same paper had accounts of several others, the Centennial, the Ironclad, and the Favourite, described as simple, compact, durable, easily understood, and will hatch every fertile egg. The Eureka, manufactured the same year, was supposed to be an improvement on the earlier ones, had a clockwork structure on the top of the machine, which showed the temperature inside, and was described as "the only incubator that can be trusted to run alone."

"Successful," hot-water incubator, 128 eggs.



"The Wooden Hen," 50 and 100 eggs.

From that date American poultry papers, like American hatching machines, were becoming plentiful; *The California Cackler*, and the *Wyandotte Gazette* advertising the Thermostatic incubator, manufactured at New Jersey, and said to be a perfect regulator of heat, automatic ventilation without cold draughts on eggs, with the proper supply of moisture, and all under complete control. Another incubator of that date

was the Climax the recommendations being that heat, moisture, and ventilation were all under complete control.

It will be seen from the above that the manufacturers of twenty-five or thirty years ago were all aware of the three essentials to secure successful hatchings, heat, moisture, and ventilation, but the fact that everyone of the machines mentioned had but a brief existence, is evidence either of poor results or excessive cost. Up to this time, 1884-5, the majority of the American machines which had appeared were a good deal on the English pattern, namely, a hot-water tank in an insulated box or chest, heated by a lamp and carried over the egg drawer. An era of new incubation methods set in about this time. Hitherto the Americans had not taken artificial incubation seriously, from the fact that the natural methods of hatching were sufficient to supply the demands for poultry. However, quicker passages and lower fares from European countries, dating from this period, enormously increased the number of English and other visitors to America, thus causing an extra demand for poultry products, the prices of which were so enhanced that thousands of people who had hitherto looked askance at poultry breeding, ventured into the business, thus creating a demand for hatching machines, and immediately a revolution in the manufacture of such set in, with the result that within the past fifteen years over 200 hatching machines have been on the American market. The effectiveness of this mode of hatching is such that now, almost every poultry concern in that country, has an incubator outfit, of from 1 to 100 machines in active operation.

That the poultry industry could not support such a number of manufacturers in this comparatively new business, can be readily understood, at the same time the system has been so largely adopted, that at present there are between forty and fifty immense incubator factories in that country, with from 1 to 500 employees each, and turning out several hundred thousand machines annually.

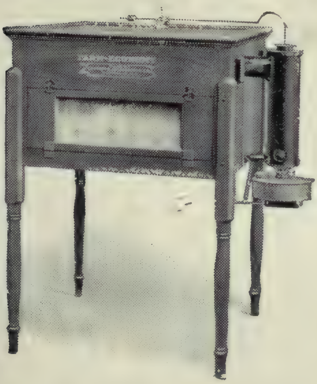
The success, however, of the American article is not confined to that country, there being large numbers of the most popular makes exported to almost every country in the world, while in every capital of the Commonwealth there are agencies for one or more of the most favoured of the American makes. The demand in this country for them is great—one selling agent in Sydney during a single season disposed of over 1,000 machines.

For many years the majority of the American incubators were of what is known as the hot water system, but in 1884, a Mr. Nix, of Illinois, who had been long experimenting, applied for a patent for a hot-air machine, and in 1886, after exhibiting it at the St. Louis Fair, put the machine on the market, and named it "The Prairie State."

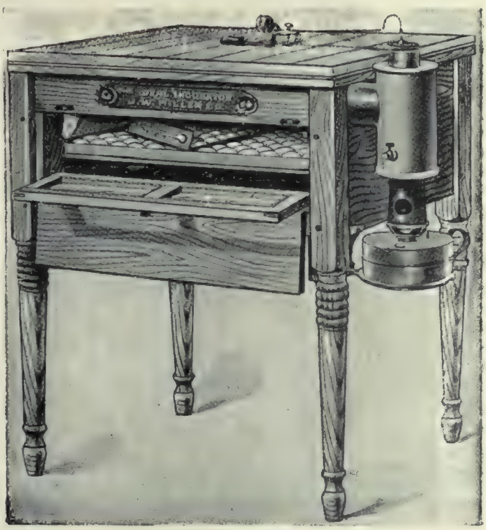
Hot-air machines had been known before, but it was said that this was the first one to give really practical results. The Prairie State Incubator Company is now a concern of great dimensions, and as far back as 1903, executed a single European order for 4,000 machines, and one of 1,200 for South Africa and Australia.

During 1903-4, the Prairie State had a great call in New South Wales. Report says it is not now so popular, but not through any reduced ability to hatch eggs, but rather a change in fashion, for, as will be seen later on, every incubator in the market, whether of American, English, or Sydney build, have given the maximum of results, and that they do not hatch 100 per cent. of the eggs, every time tried is due to other causes than the construction of the apparatus.

Another American hot-air machine in the Sydney market is the Petaluma, manufactured in the town of that name in California, some 38 miles from San Francisco. This machine dates back to 1879. It was in the zenith of its popularity here some five or six years ago, when some thousands of them were disposed of in Sydney. Through some cause it is now less patronised than formerly, but not through inability to do good work, many most successful hatches being recorded from every county and corner in the State. The Wooden Hen and the Excelsior are two other American incubators which have an agency in Sydney. A few years ago the big meat-exporting firm of Baynes Bros., Brisbane, had forty-five of the latter installed in their large incubator room. They are manufactured by G. S. Stahl, Quincy, Illinois, who claim that in the hands of intelligent operators they do their work



"The Cyphers."



"The Ideal."

with uniform success. The De Moines Incubator Company, Iowa, United States of America, have a Sydney agency for their Eclipse and Crescent hatchers. They can be had with either hot air or hot water, and equal results are claimed for the two systems.

The Cyphers is another hot-air incubator of growing popularity in this State, the sales each year largely increasing. The manufacturers say it is built for business, and sold for honour, but like those already noted, it can

do no more than hatch 100 chickens from 100 eggs, and though this is not frequently done by any of them, there is no questioning the fact that every incubator mentioned has at one time or other given results equal to 100 per cent., 90 to 95 being of frequent occurrence.

The "Ideal," is another American incubator of comparatively recent introduction to New South Wales, and has already made many friends, the sales for 1908 being considerable. It is made by the J. W. Miller Company, of Freeport, Illinois, who are so confident of its results that it is sold in America on a ninety days trial. The Ideal can be had on either the hot air or hot water system.

This about exhausts all the American-made incubators that have agencies here. There are a large number of other popular makes in the United States, a few of which have reached here, but there is no Sydney depôt, the best known being the Old Trusty, The Sure Hatch, The Cortland, The Pineland, The Racine, The Star, The Defiance, The Ohio, The Cornell, The Burr, The Shaub, The Globe, &c.

(*To be continued.*)

Farmers' Experiments.

Some of the Results.

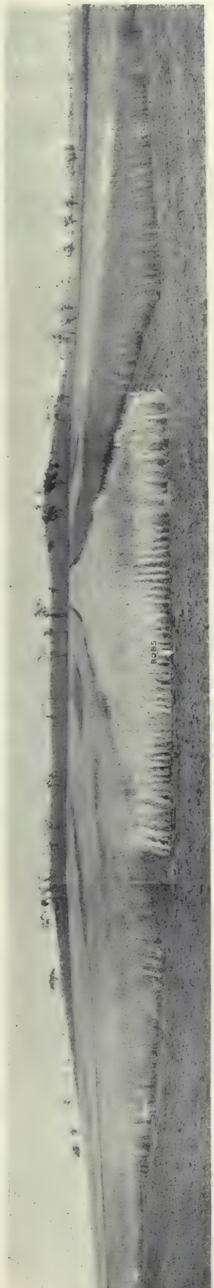
G. VALDER, Acting Chief Inspector.

Wellington.

One of the first to support the movement initiated by the Minister was Major C. H. Barton, M.L.A., of Wellington. This gentleman, whose farm "Towri" is situated at Maryvale, 6 or 7 miles from Wellington, stated that he was thoroughly in accord with the scheme of Farmers' Experiments, and that the Department could select up to 100 acres on any part of his farm which he would be glad to give for the purpose free of charge. This offer was accepted, and eventually a paddock of 38 acres in area, fronting the main Wellington to Cobborah road, was selected. The soil is a red to chocolate loam, a very fair average of the district, and being conveniently situated it was considered very suitable for the purpose. It had been cropped almost continuously for thirty years without manuring. Wheat was grown on it in 1906, and in 1907 it was sown down to rape and fed off with sheep. The land was then ploughed in February last and again in April. During the growth of the crop only 516 points of rain fell; besides this the winter proved a severe one, and the heavy late frosts had a marked effect upon the crops, as they caught the wheat just when it was flowering.

The manager of Towri (Mr. Wren) stated that these late frosts, which occurred up till the 20th October, were more severe than any experienced during the sixteen years he had been at Towri. Added to this there was practically no spring, and therefore the trial was a severe one in every way. On the other hand, there is no doubt that the early ploughing of the land enabled the crop to benefit by the rains which fell from February to April.

The paddock was laid out in plots of 10 chains by ½ chain, *i.e.*, half an acre, and a space of 8 feet



General View of the Wheat Plots at Towri, near Wellington.

in width was left between the plots (see illustration). Upon the fence fronting the main road, boards were placed on which the names of each variety were plainly stencilled, so that they attracted the attention of every passer by. Farmers were thus enabled to inspect the plots and watch the growth of the different varieties.

The experiments were divided into local varieties *v.* wheats recommended by the Department, and to manured *v.* unmanured plots. For the variety trial, Chaunt's Prolific and Marshall's No. 3 were selected as being the best of the locally-grown varieties, and the following were tried upon the recommendation of the Department, viz. :—Federation, Bobs, Jumbuck, and Comeback. Besides these, the following varieties which had been under cultivation at Towri were tried, viz. :—John Brown, Plover, Schneider. and Tarragon. The whole of these wheats were sown on the 6th and 7th May, being put in with a Massey-Harris 15 tine disc drill. The land had been well harrowed and then rolled before sowing ; after this no cultivation was given.

The harvesting was done with the harvester, and in order that the grain might be kept pure the machinery was cleaned after finishing each plot, being first well brushed out and then thoroughly cleansed by means of a steam pipe from an engine which had been brought up to a position convenient to the plots (see illustration). This proved a very effective way of cleaning out the harvester. Harvesting commenced on the 30th November, and was completed on the 4th December. The results were as follows :—

Variety Trial.

		bus.	lb.
Plot 1.	Chaunt's Prolific	11	51
2.	Federation	12	37
3.	Bobs	10	30
4.	Jumbuck	8	2
5.	Comeback	10	51
6.	Chaunt's Prolific	10	24
7.	Tarragon	6	32
8.	John Brown	9	31
9.	Plover	10	0
10.	Schneider	10	33
11.	Marshall's No. 3	12	5
12.	Chaunt's Prolific	11	56

Of the wheats recommended by the Department, Federation was easily first, and it also gave better results than the local wheats. Though not so high as some of the other varieties, the crop was a more even one and the ears were well filled.

Comeback during the early part of the crops' growth showed out far better than any other wheat, and most of the farmers who saw it thought that it would come out at the top. The dry weather, however, affected it more than it did some of the other varieties ; still it must be regarded as one of the most promising wheats yet tried here. It stripped well, and the grain was of excellent quality.

Bobs is considered in this district to be one of the best dry climate wheats. It again gave an excellent yield of both grain and hay ; it stripped easily, and the grain was a good even sample.

Schneider also yielded well, both for grain and hay. An 85-acre crop of this variety on Mr. Barton's farm near to the plots was said to be the finest crop in the district.

Plover also, both in the plots and on the larger areas, has proved a good hay and grain wheat.

Jumbuck was a fine strong-growing crop which promised well, but the ears did not fill and the yield was disappointing.

John Brown is regarded here as a good all-round wheat.

Tarragon, as was expected, proved to be too late a variety for this district, being the latest of all.

The local varieties both came out well, there being little difference in yield of both grain and hay.

The average yield of grain from these plots, which were unmanured, was a little over 10 bushels to the acre, and yet for the district it is stated that the yield only averaged 2 bushels, it being one of the worst seasons on record.

Wellington Experimental Plots—Cleaning out Harvester with steam pipe from engine.

Manurial Trial.

Sown 6th and 7th May.

			bus.	lb.
Plot 12.	Chaunt's Prolific ...	No manure	11	56
13.	,, ,, ...	146 lb. superphosphate per acre; cost, 6s. 6d.	12	50
Plot 14.	Federation	No manure	10	47
15.	,, ...	68 lb. superphosphate per acre; cost, 3s. ...	16	0
Plot 16.	Bobs	No manure	9	50
17.	,, ...	68 lb. superphosphate per acre; cost, 3s. ...	11	6

Sown 22nd May.

Plot 18.	Rymer	No manure	9	41
19.	,, ...	68 lb. superphosphate per acre; cost, 3s. ...	11	4
Plot 20.	Bunyip	No manure	8	54
21.	,, ...	68 lb. superphosphate per acre; cost, 3s. ...	12	14

The four plots on which 68 lb. superphosphate per acre had been sown averaged $12\frac{1}{2}$ bushels per acre, and the four without manure $9\frac{3}{4}$ bushels, so that, by the addition of manure costing 3s. per acre, we get an increased yield of $2\frac{3}{4}$ bushels, which, at 3s. 6d. per bushel, equals 9s. $7\frac{1}{2}$d., or a net profit of 6s. $7\frac{1}{2}$d. Besides this, we must remember that the season was a very unfavourable one for the manure, the rainfall being too light to allow of its acting fully upon the crop; therefore the manurial trial was remarkably successful.

Wellington Experimental Plots—Half-acre Plot of "Bobs" Wheat.

For plot 13 a heavier dressing of manure was given, viz., 146 lb. per acre; this, however, only showed an increase of 1 bushel per acre, and therefore the heavier dressing did not pay. On the other hand there was an increase of nearly 50 per cent. in the yield of straw from the manured plot, being a far greater increase than on any of the other plots.

Wellington Experimental Plots—Two of the long narrow plots, with space between.

This tends to show that in a dry season for grain light dressings of manure give the best results, but for hay crops heavier dressings can be given.

The experiments at Wellington this season were a distinct triumph for proper cultivation, manuring, and drilling. Many of the crops in this district had received little care in cultivation; the seed was broadcasted and no manure was used, with the result that the average for the district is only about 2 to 3 bushels of grain per acre and 7 to 10 cwt. of hay, whereas the average at the plots was over 10 bushels of grain to the acre, the actual figures being 10 bushels 49 lb., and from 15 to 25 cwt. of hay. There can be no question but that, had the farmers in this district adopted up-to-date methods during the past dry season, they would have had profitable crops instead of heavy losses.

Orange.

The experiment plot for the Orange district was selected on Mr. George Worboys' farm, at Spring Hill. The land is a light, sandy, red loam, a fair average of the wheat lands of this district. It has been under cultivation for many years. The area is 7½ acres. This was divided into fourteen ½ acre plots, the remaining ½ acre being taken up by the dividing spaces. The land was fallowed, ploughed the second time in March, and then well harrowed and rolled. Sowing then took place on the 13th April, the seed and manure being put in with a "Farmers' Favourite" drill. Two experiments were conducted, the first being a trial of local varieties *versus* wheats recommended by the Department, and the second, manured *versus* unmanured plots. For the first trial, the local varieties selected were White Hogan and Selected Purple Straw, the former being considered the best variety for hay, and the latter for grain. The varieties recommended for trial by the Department were Federation, Bobs, Tarragon, Comeback, and Jumbuck. Two ½ acre plots of each of these varieties were sown, one of each being without manure, and the others with 40 lb. of superphosphate—*i.e.*, at the rate of 80 lb. per acre, costing 3s. 6d. During the crops' growth there was a total rainfall of 734 points, rain falling on twenty-two days. The crops were harvested on the 23rd and 24th December, a McCormick harvester being used for the purpose. The results were as follows:—

	Unmanured. Bus. per acre.	Manured. Bus. per acre.
Federation	17⅙	23½
White Hogan	18⅚	18
Bobs	14	18
Tarragon	13⅓	18
Comeback	12½	17
Purple Straw	12⅓	16
Jumbuck	9½	12⅓
Average	14	17½

In the variety trial, it will be seen that Federation again comes out on top; but the objection to this wheat is that it is not nearly as good for hay

as some of the old varieties, and this is a big consideration in this district, much larger areas being cut for hay than for grain. Comeback promised remarkably well early in the season, but being a quick growing variety, the rains which fell early in December came too late for it, although in time to benefit the others, and, as a result, it did not take nearly as high a position as expected. Considering its high milling value, in comparison with the wheats grown locally, as well as the strong growth it made during the early part of the season, I certainly think that it is a variety which should be extensively tried in this district. Bobs gave a good all-round result, the yield of both grain and hay being high. Of the local varieties, White Hogan gave far better results both for grain and hay than Purple Straw, and proved to be a good all-round variety.

In the manured and unmanured trial, the manured plots were again a great success. With the exception of White Hogan, all of the manured plots showed a greatly increased yield; and in the case of this exception, it may be stated that the low yield of the unmanured plot was due to a quantity of the grain having been knocked out by the horses in the harvester having to walk over this crop while harvesting the adjoining plot. Had it not been for this, it is estimated that the yield of the manured plot would, as with the others, have exceeded that of the unmanured. By applying 3s. 6d. worth of manure per acre, an increased yield of 3½ bushels was obtained, which, at 3s. 6d. per bushel, means 12s. 3d. per acre. It is a strange thing that the farmers in this district do not use superhosphate on a much larger scale. This experiment serves to confirm the statement so often made, viz., "that by drilling in small quantities of superphosphate with the seed, a greatly increased return can be obtained."

On Bird Protection and Bird Destruction in New South Wales.*

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THE amount of ignorance that exists as to the number of species of birds afforded protection in New South Wales is evidenced by the many letters appearing from contributors to the metropolitan and other newspapers. During the present and in recent years letters have appeared from individuals bewailing the unrestrained destruction of bird-life going on, and stating that, although the Government of the day had been approached with lists of birds that should also be included in the Birds' Protection Act, nothing had been done. Others complained, and rightly so, of birds in the outlying suburbs being shot in the breeding season, or of the ruthless shooting of sea birds in the bays of Sydney Harbour or from the decks of steamers or other vessels near the coast.

For the first time, so far as I am aware, during my period of nearly twenty-two years' service, the Curator of the Australian Museum, in 1905, was asked, in conjunction with the Inspector-General of Police, to furnish a list of Australian birds, to be added to the schedule of the "Birds' Protection Act, 1901." As far as the Australian Museum is concerned, I was instructed by the Curator to draw up this list, and, with a few exceptions, I am responsible for it in its entirety. One objection, too, I made was against the inclusion of the King Lory or "King Parrot" (*Aprosmictus cyanopygius*), owing to its destructive habits in maize and other crops. At the same time a list was drawn up of Australian birds that, in pursuance of the power conferred by section 11 of the "Native Animals Protection Act, 1903," were subsequently absolutely protected for a period of ten years.

Who drew up the lists of the foreign and Australian birds in the schedules of the "Birds' Protection Act, 1901," I know not. Included in the former was the Nightingale (*Sylvia luscinia*), which I am certain at that time, did not occur in a state of nature in any part of the State, and Grouse and Partridges of every species, included under the generic names only of *Tetrao*, *Lagopus*, and *Perdix*. In the schedule of Australian birds are included, among others, "Seagulls of every description;" "Wild Ducks of every species, including Teal;" "Plovers of every species;" "Pigeons and Doves of every species;" "Wild Geese of every description;" "Swamp Pheasant;" "The bird commonly known as 'The Happy Family,' or 'The Twelve Apostles,' entirely destitute of any systematic names.—" Lyre

* Abstracts were read from this paper during a discussion on the protection of the native fauna and flora, at a meeting of the Linnean Society of New South Wales, held on the 26th August, 1908.

Birds," "Wood Swallows," "Robins," and "Honey-sucker" have opposite to them, respectively, the generic names only of *Menura*, *Artamus*, *Petrœca*, and *Meliornis*. "Fish Hawks or Sea Eagles" have opposite to them the generic names of *Haliœtus*, *Haliastur*, and *Pandion*, and the "Kingfishers," those of Halcyon and Alcyone; while wedged in between the Gang Gang Cockatoo and Butcher Bird is the acclimatised "Indian Minah" (*Acridotheres tristis*).

Unfortunately the above schedules of the "Birds' Protection Act, 1901," could not be altered except by Act of Parliament, although they could be added to, and they were printed in their entirety, with the additions made, and published in the *Government Gazette* of the State of New South Wales, No. 563, on Tuesday, 31st October, 1905.

The Hon. J. A. Hogue, M.L.A., the then Chief Secretary, and present Minister of Public Instruction, authorised these additions. Mr. Hogue is both a lover of birds and of music, and is more especially interested in the singing birds of the State.

Among the species absolutely protected for a period of ten years from the 31st of October, 1905, of which the common and systematic name of each are given, are the Rifle bird, Regent Bower bird, Magpie Lark, all species of Flycatchers, Robins, Superb Warblers, Tree Creepers, Swallows, Lyre birds, Black Cockatoos, Kingfishers, Cuckoos, Owls, Egrets, Herons, and Ibisis; the Noisy Pitta or Dragoon bird, the Coachwhip bird, the White-bellied Sea Eagle, the Wonga Pigeon, and the Stone Plover.

By the "Birds' Protection Act, 1901," and the additions made thereto in 1905, many other species are protected through their normal breeding seasons. It is impossible to afford full protection to many species, unless absolute protection was given, for many are irregular breeders, like the pigeons and doves, which may be found breeding during any month of the year. Ducks, which usually breed in July and August, will breed in February and March, after a heavy rainfall, and especially when preceded by a severe drought. The Stubble Quail (*Coturnix pectoralis*), and the different species of the genus *Turnix*, are also irregular breeders. A close season, therefore, for all of these birds, by no means affords absolute protection, but only for their usual breeding season. The "Birds' Protection Act" was originally drawn up to prevent the reckless destruction of bird life, and particularly during the breeding season, in the interests of not one particular section, but of all classes of the community in the State. Persons who make a living by shooting, and sportsmen, have just as much right to consideration as those who collect specimens for a hobby or for a scientific institution.

I have already pointed out in various journals, and in unsigned articles in newspapers, the destruction of bird-life going on in New South Wales. The many causes will be found in a paper published in the "Records of the Australian Museum," entitled, "The Destruction of Native Birds in New South Wales*." The chief factor is the importation of foreign mammals

* North, Rec. Austr. Mus., vol. IV, p. 17 (1902).

that has directly and indirectly caused the destruction of a vast number of our Australian birds. Poisoned pollard, laid and partially buried for rabbits, is responsible for the loss of thousands of birds every year. The introduced fox, now thoroughly acclimatised in Victoria and New South Wales, in addition to its ravages during the lambing season, captures and devours, among others, a large number of Lyre birds. Many birds, too, are wantonly destroyed by shooting, frequently in the breeding reason, when young birds are left to perish miserably or eggs to rot in the nest. I here quote a paragraph of this paper:—"Large areas of still unalienated virgin brush lands and mountain range should be perpetually reserved in the haunts of these beautiful birds (referring to the Lyre bird, Rifle bird, and Regent Bower bird), and the entire flora and fauna of these reserves kept sacred and zealously guarded against all would-be destroyers." Briefly summed up, the facts are these: Partly through nature's laws, and partly through ignorance, carelessness, and design, the destruction of bird-life has been for years past, and is still going on, almost unrestricted. Through nature's laws by the growth of cities and suburbs, the felling and burning of brush and forest lands in the country districts and bush fires; by the ignorance of boys and youths not knowing the damage they are doing in shooting birds throughout the year; through carelessness on the part of persons introducing foreign mammals and birds into Australia, and ignorant whether their introduction will prove beneficial or harmful; by design in the wilful trapping and shooting of birds in the close season. Where preventible, is this annual loss of bird-life to continue?"

Since the above was written—a little more than six years ago—the fox, whose ravages were then confined chiefly to the southern boundary districts of New South Wales, has extended its range through the north western part of the State into south-western Queensland. Mr. S. Robinson informs me that a fox was killed on Burrenbilla Station, near Cunnamulla, on the Warrego River, fifteen months ago, and in that district the foxes were now destroying, among other ground birds, the Brush Turkey (*Catheturus lathami*), while in north-western New South Wales this pest had considerably thinned in numbers the Mallee Fowl (*Lipoa ocellata*). From experience I know, too, that the poison-cart is still continuing its deadly work, chiefly in the western portion of New South Wales. Birds are still ruthlessly destroyed in the breeding season in many places, and almost at the doors of outlying suburban residents. Of the practical extermination of many species in districts where they were once common, by means of poisoned pollard laid for rabbits, I have spoken out several times in newspaper articles, and more particularly in one entitled "The Trail of the Poison Cart," and of the destruction of birds during the breeding season in another, entitled "A Plea for our Birds."

In the "Records of the Australian Museum"† it was pointed out that shooting of birds and the indiscriminate egg-collecting by boys was, in ninety-nine cases out of a hundred, due to thoughtlessness, and not want of heart; and that in the United States of America the mischief wrought was shown

† Rec. Austr. Mus., vol. IV, p. 18 (1902).

by many teachers in the public schools, Bird Day there being also an annual institution, like Arbor Day.

Since doing so, nature study has been introduced into many schools in Australia, and now forms part of the curriculum of a public school teacher in the service of this State, its chief exponent being Mr. A. G. Hamilton, at the Training College for Teachers, at Blackfriars. Nature study in Australia is as yet in the bud, but already it gives promise of bursting into bloom, and yielding forth good fruit, as it has done in America and elsewhere.

For years past I have suggested that the "Birds' Protection Act, 1901," together with its by-laws and the additions made to it in 1905, should be printed in bold type in its entirety, and conspicuously displayed at every public school, post office, railway station, and court-house in the State. During a trip to the northern rivers, towards the latter part of 1907, I observed this had been done, and a copy posted up outside the court-house at Grafton, where, by the reports in the newspapers, the police are, apparently, more persistent in their efforts in prosecuting offenders against its by-laws than elsewhere. Far more reaching in effect would it be if the proprietors of newspapers published the "Birds' Protection Act, 1901," and its additions. The whole of it could be compressed into about a column of small type. I am certain that, for those interested in bird protection, and to many residents in the country, no cutting would be more faithfully treasured. Below is given its title and some of its by-laws :—

Short title.

"1. This Act may be cited as the "Birds' Protection Act, 1901."

Penalty for killing, &c., scheduled birds during the close season.

6. Whosoever during the close season wilfully kills, captures, or injures, or attempts or uses any means whatever to kill, capture, or injure any scheduled bird shall, for every such offence, be liable to a penalty of five pounds.

Penalty for having dead birds in possession.

7. Whosoever sells or offers for sale, or has in his control or possession during the close season any scheduled bird recently killed or taken shall, for every such bird, be liable to a penalty not exceeding five pounds, unless he proves that the bird was killed, taken, bought, or received either during the period in which such bird could legally be killed, or in or from another state or colony.

Penalty on taking or destroying eggs.

9. Whosoever takes out of the nest or destroys in the nest the eggs of any scheduled bird shall be liable to a penalty not exceeding the sum of ten shillings for each egg so taken or destroyed.

Penalty for refusing to give name, place of abode, &c.

13. (1) Any householder or constable may require any person offending against any of the provisions of this Act to give his name and full place of abode.

(2) If such person, after being so required, refuses to give his real name or place of abode, or gives a false or fictitious name, he may be at once arrested and taken before some justice of the peace, and shall be liable for every such offence to an additional penalty not exceeding five pounds.

14. All information or charges for offences against this Act may be heard and determined before one justice of the peace. Prosecution of offences.

15. All penalties under this Act shall be paid—one-half to the person who, in the opinion of the convicting justice of the peace, gave such information as led to the conviction, and one-half to the Zoological Society. Disposal of penalties.

16. This Act shall not apply to any person authorised by the Colonial Secretary to collect specimens of natural history for any scientific institution or museum." Exceptions.

It is impossible to make a hard and fast rule in bird protection that applies with equal justice to all engaged in rural pursuits. Take, for instance, the different species of Wood Swallow belonging to the genus *Artamus.* No one who has had any experience at all would question for a moment the vast amount of good these birds do for pastoralists and agriculturists, in ridding their grass lands of many injurious insect pests. At the same time, from personal observation, and shooting several birds in the act of destroying bees, and examining the contents of their stomachs, I know that they are, without exception, the most dreaded scourge of the apiarist. This testimony has been corroborated in correspondence received from apiarists and by the Curator of the Australian Museum, and observers, chiefly in country districts. As I have mentioned elsewhere, the "Birds' Protection Act" is often more honored in the breach than in the observance of its by-laws, consequently, when one finds birds injuring his flocks, crops, or other property, he does not wait to consult the Act, but usually promptly shoots the offender on the spot. One need not, however, go out of Sydney to look for breaches of its by-laws

By the "Birds' Protection Act, 1901," and the additions made to it, ample provision has been made by its by-laws for the protection during the breeding or close season of the useful, edible, and ornamental birds of this State. Moreover, many of them, since the 31st October, 1905, are included in the schedule of birds which are absolutely protected for a period of ten years. Among the latter are the different species of Fly-catchers, Cuckoos, and Ibises; the Egrets, with their graceful form and snowy-white plumage; the brilliantly-plumaged Rifle-bird and Regent Bower-bird; and the best of all mocking-birds, the three species of Lyre-birds inhabiting Australia, all of which are found in this State.

Bird protection, although one may make suggestions for its welfare, hardly comes within the province of a scientific society, or from one connected with a museum. Members of any society who form either bird-skin or egg collections, or both, and they are many—whatever may be professed to the contrary—cannot pose as champions of bird protection. The basis, too, of systematic research in ornithology, like any other branch of Zoology or of Botany, must be founded on the actual study of specimens. I do not wish to infer that one who collects birds or eggs cannot assist in giving protection to birds; but, at all times, whether in collecting for a hobby, or in the performance of one's official duties, in making suggestions for bird-protection, it must, in every instance, be a case of do as I say, not as I do. For years

past, at Roseville, I have encouraged the birds to breed around my house, and when unmolested, it is astonishing how soon they learn that the garden is their sanctuary. Honey-eaters of several species come regularly to drink or bathe in the summer time, to a large earthenware bowl of water placed there for their use. Young Magpie Larks, being fed by their parents or searching for food themselves, scarcely trouble to move out of one's way. Yellow-breasted robins, breed in the trees just outside the fence, and one season, in low bushes, the Coach-whip bird. The Grey Shrike Thrush is very tame, and utters its melodious notes on the verandah and ventures into the house, and, last year, a pair of Black and White Fantails (or more popularly known "Willy-wagtail") forsook their usual nesting-place in a tree in an adjoining paddock, and built their nest and reared their young on the beam of a wooden screen sheltering one of our windows. While in the field, too, I have caught young birds, taken them into the Museum on the following day, photographed them, described them, and walked many a mile afterwards to return them to their parents.

In Australia, as elsewhere, true bird protection must come from the people themselves, who neither form bird-skin or egg collections, or are interested directly or indirectly in the sale or purchase of specimens. In England this work is performed by the Royal Society for the Protection of Birds, and various plumage leagues and sections of other societies. In the United States of North America, bird protection is brought to a more perfected state than elsewhere. "In thirty-nine States the enforcement of game laws is entrusted to game commissioners, wardens, or other State officers; in seven others, to country wardens; in Virginia, to city and magisterial district wardens; in Arkansas, to sheriffs and similar local officers; and in the District of Columbia, to the metropolitan police. . . . . and thirty-eight States have Audobon Societies, organised especially for the study and protection of non-game birds."*

The literature of bird protection is voluminous, especially in reference to the United States. Of recent important publications may be mentioned the works and papers of Mr. T. S. Palmer, Assistant in Charge of Game Preservation, and of Mr. R. W. Williams, junior, Game Law Assistant, Biological Survey, Washington, and of Continental publications bearing on the subject, "The International Convention for the Protection of Birds."†

Finally returning to bird protection in New South Wales, so far as the by-laws and the various schedules of the Birds' Protection Act are concerned, all species requiring it are amply protected in the close season. We have not in Australia, as in America, a paid administrator, wardens, bailiffs, and watchers, to ensure the provisions of the Game and Birds Protection Acts being carried out, but it will, undoubtedly, come in time, as the country is developed.

One result of the absolute protection, for a period of ten years, of all three species of Lyre-birds inhabiting New South Wales, is that one no longer sees

* Palmer, United States Department of Agriculture—Circular No. 62, issued 25th July, 1907. † Budapest, Hungary, 1907.

the tails of these beautiful birds hawked about in baskets in the streets of Sydney. On the holidays proclaimed on the 21st and 24th August, 1908, in honour of the visit of the American Fleet, I noted, too, during bush rambles in the neighbourhood of Roseville, Chatswood, and Middle Harbour, an almost total absence of youthful gunners. This was due, probably, not so much to any restrictive by-laws as the superior attractions of the fleet, then in Sydney Harbour.

As I have pointed out elsewhere, why not form "Gould Societies" all over Australia for the protection of our birds, and perpetuate the name (if such be required) of one who, by his painstaking labours, has left us so rich a legacy in his beautiful work on Australian birds? It has already been shown by the by-laws quoted, of the "Birds' Protection Act, 1901," how anyone so disposed can prevent the destroying of protected birds in the close season, or, if the offence is persisted in, that it can only be done at the risk of a heavy penalty.

Australian Meat Trade with Switzerland.

The Agent General for New South Wales in London has reported to the Minister of Agriculture, that he has been making every effort to induce Australian firms to open up business relations with Switzerland, with a view to obtaining the introduction of Australian frozen meat into that country.

In connection with this matter the Agent-General finds that while fresh meat, including the flesh of horses, oxen, goats, sheep, and pigs, is permitted to enter Switzerland if accompanied by a certificate of origin signed by an officer of the Swiss Veterinary Service, testifying that it is sound and comes from an animal free from any contagious or infectious disease, and also hams, bacon, lard, and even sausages are permitted entry on the same conditions, under cover of these sanitary regulations, the importation of frozen meat is absolutely prohibited.

Mr. Coghlan has, therefore, addressed a communication to the Colonial Office, pointing out that as no meat, unless examined and passed by the Health Authorities of Australia is allowed to go into consumption or export, the extension of the Swiss prohibition to Australian meat has been brought about in ignorance of the true facts of the case, and the Agent-General asked that the efforts of the Secretary of State might be directed, in the first instance, towards securing a modification of the sanitary regulations which would permit the importation of Australian produce.

Preservative Action of Boric Acid in Butter.

Its marked influence.

Second Experiment.

M. A. O'CALLAGHAN, Dairy Expert.

At the Berry Central Butter Factory on the 20th October last, an experiment in connection with preservative influence of boric acid on butter was made and carried out on exactly similar lines to the experiments made on the 28th August, 1908, and reported on page 1033 of the *Agricultural Gazette* of December last. The churning operations and general manufacture were superintended by Dairy Instructor C. Pedersen. All conditions were normal, and the cream used when manufacturing was what is generally known as first-class, but had not been very strictly graded. 100 lb. of butter were taken from the churning, and divided into three parts—*a*, *b*, and *c*. To the portion marked *a*, salt at the rate of 3 per cent. was added; to the portion marked *b*, salt at the rate of 3 per cent. together with ½ per cent. of a preservative, consisting mainly of boric acid, were added. To portion *c*, salt at the rate of 3 per cent. and a similar preservative at ¼ per cent. were added. All butters were worked once only, and packed in 28 lb. boxes. The boxes were placed in the ordinary cool-room of the butter factory for a couple of days, and then despatched to Sydney in the usual way and placed in cold-store. The temperature of the room would rarely exceed 20 degrees Fahrenheit. Previous to placing in cold-store it was examined, and points awarded for flavour, with the following results:—

a	43 points.
b	44 „
c	44 „

On the 16th November, or just about four weeks after the date of manufacture, the butter was taken out of cold-store and graded, the following points being allotted to the different butters for flavour by the writer:—

a	40 points.
b	43 „
c	42 „

At this stage, butter *a*, had dropped to, practically speaking, a second quality butter in flavour, according to the usual grading standards; whereas *b* had retained its keeping qualities nearly in full; and *c* had shown slight evidence of deterioration.

On the 12th December the butter was removed from cold-store and allowed to stand at a temperature of 70 degrees Fahrenheit for forty-eight hours, with the following results:—

a	34 points.
b	39 „
c	37 „

It may be added that Messrs. Pedersen, Stenning, and MacInnes all placed the same butters in the same order as the writer on the 14th December. The temperature of the butters had risen to 60 degrees Fahrenheit at the time of examination, and no doubt decomposition took place rapidly during the forty-eight hours the butter was out of cold-store. Still, this test is the one commonly given to butter in a grocer's establishment, where it is being retailed.

The identity of any of the butters was not known during the examination, and it is thus seen that from the time the butter was first examined—four days after the date of manufacture—the advantage in flavours of butters containing boric acid was observed. No doubt, had the cream been more strictly graded and only very high-class creams used in the manufacture, the difference in flavour of butters to which boric acid had been added would not have been so marked; but the fact remains that the cream was so well up to the standard generally used in the manufacture of first-class butter, and the results speak for themselves. It is noted that the butter to which ½ per cent. of preservative had been added retained its flavour in full while held in cold-store for the first month after date of manufacture; whereas that to which only ¼ per cent. had been added showed only slight evidence of decomposition; while, on the other hand, the butter to which no preservative had been added, other than salt, had shown a marked deterioration, and taste and flavour indicated that injurious fermentations were proceeding, notwithstanding the low temperature at which the butter had been held.

Chemical analysis showed that the butters contained the following percentages of boric acid and water:—

	Boric acid.	Water.
a	Nil.	11·57 per cent.
b	0·21 per cent.	11·06 ,,
c	0·13 ,,	11·13 ,,

Bacteriological examination, made soon after manufacture, showed, as was of course expected, that the three butters contained, practically, not only the same species and varieties of micro-organisms, but the same number of each variety; that, after forty-eight hours' growth, practically nothing was in evidence but colonies of the ordinary lactic-acid bacillus. Later on some colonies of a small liquifying organism presented themselves. Plate representing butter *a*, showed eight colonies of this organism; plate *b*, showed seven colonies; and plate *c*, nine colonies.

The chemical analysis again shows, as in the previous experiment, the great loss which takes place in the preservative during the process of working the butter—a loss approximately amounting to one half of what had been added; but, of course, this may not and does not occur to the same extent with all preservatives.

Attention might again be drawn to the great preserving influence of boric acid, even in these small quantities. The preservative, it is presumed, is dissolved in the water in the butter, and the solution thus contained, in the case of *b*, 1·9 per cent., and in the case of *c*, 1·1 per cent. of boric acid.

Harvesting Wheat and Barley.

G. M. McKEOWN, Manager, Wagga Experiment Farm.

THE use of the reaper and binder is recommended for the following reasons, viz. :—

1. It is possible to place in a position of security a crop, or a considerable portion of it, while it is in a condition in which it is far less liable to damage than when it is left to ripen sufficiently to render possible other methods of harvesting.
2. A crop is in a condition for cutting about a fortnight earlier than is possible for stripping, and the work of cutting may proceed under weather conditions unfavourable for the latter work, thereby admitting of much time being gained.
3. When a crop is allowed to ripen to the degree necessary to admit of stripping, one day's hot wind may cause the loss of the entire standing crop, while such conditions would be harmless to stacks, and comparatively so to wheat in stooks.
4. Much less grain is shed during the cutting of a crop which is seasonably dealt with than is the case when the stripper is used under its most favourable conditions, and the binder removes and includes in the sheaves the whole of the ears, while in an irregular crop many low heads are left untouched by the stripper.
5. The weight and colour of the grain which has been cut and stacked are superior to that harvested by other means, as in the latter case bleaching and loss of weight are to a greater or less extent inevitable.
6. Land upon which crops have been cut will always be found freer from wild oats and weeds, as such plants are to a great extent removed in the sheaves and dealt with in threshing.
7. The value of the straw is always worthy of consideration, as, no matter how long it may be kept, our experience has shown that periods will occur when its value will be considerable.

This is, practically, admitted by many wheat-growers who, at present, use the harvester or stripper for their grain, as they afterwards cut the straw with the reaper and binder. Many, however, destroy the whole of the straw by fire, thus depriving the soil of even the benefit of ploughing in the stubble, such as is left by the reaper and binder. After the stripper or harvester much of the straw cannot be harvested owing to it having been knocked down by the first teams and machines, while the value of the rest has been greatly depreciated by bleaching. In the long run it will be found that the extra cost of cutting, stacking, and threshing is far more than compensated for by the advantages gained.

A difficulty exists in many districts owing to the lack of contractors for threshing, but the demand would induce a supply. The economy of cutting

and threshing even a portion of the crop is strongly urged. In districts where the practice has been tested there is no desire to depart from it. In our own district, since the drought of 1902, I know that there has been a demand for threshing of grain at double the rates prevailing in districts where threshing is the rule, and where, in consequence, more contractors' plants were available.

Time to cut.—Cutting should be commenced when the crop presents an even condition of ripeness, which will be evident in the rapid drying of the straw from the lower joints upwards, and in the condition of the grain, which should be well set and quite firm.

Stooking.—This work should be carried out with the greatest promptness, a sufficient gang of stookers being allowed to keep pace with each machine, so that at the close of the day's work no sheaves shall be left lying on the ground where they will be subject to injury by drawing moisture from the soil. Even should the soil be dry, delay in stooking may cause loss of grain, especially when the straw dries rapidly, through the great heat which at times prevails.

Stacking.—Carting to the stacks should be placed in hand as soon as the sheaves are sufficiently dry to avoid risk of sweating, the bottoms of all vehicles being covered with large cloths to prevent the loss of any grain which may be shed in the handling. All stacks should have their bases secured against risk of moisture rising from the soil by a good layer of straw or timber, and drainage should be provided to protect them from damage by surface water. The best size for stacks is about 27 feet x 15 feet, to contain about 50 tons. This size is about the most economical of labour in construction, as well as in demolition for the purpose of threshing or chaff-cutting. The width should be gradually increased to 18 feet at the eaves, thus ensuring proper drainage from the roof, as the water should fall clear of the sides of the stack. The sheaves should be carefully placed in position, butts outwards, with a slight downward slope outwards, which is obtained by keeping the middle of the stack well filled and slightly raised, care being taken that all sheaves are properly bound in position by others. A skilful builder will accomplish the work with a fork without the necessity of kneeling to put the sheaves in position, the former method being more expeditious. The access of rain should be prevented during during the process of erection. The eaves should be about 12 feet from the ground, and to form them the last row of sheaves should project about 6 inches. To gain the necessary pitch to the roof three double rows of sheaves should be placed in the middle of the stack, lengthwise; but if the sheaves are not bulky more may be required. The necessary pitch may be maintained by placing each layer of sheaves (still butts outward) further back than that next underlying it, so as to obtain a continuous slope to the ridge, the relative position of the middle being carefully continued, and the outer sheaves bound by the inner rows.

In the Wagga district, where the rainfall is not heavy, we are able, by this method of building and topping stacks, to dispense with the expense of thatching, as only the butts of the outer sheaves become damaged. These are cut off and the upper portions of the sheaves are used as stock food when the material stacked is hay.

Haymaking.

G. M. McKEOWN, Manager, Wagga Experiment Farm.

Wheat.

Cutting of the crop should be commenced when the earliest of the flowers are appearing, as it is desirable that it should be cut before the grain forms in the straw.

Wheat is an indigestible grain, with which it is easy to overfeed horses and cattle; therefore, if it is desired to use it, it is better to add it to chaff, and to crush or boil it before doing so.

The hay, also, when saved at that stage of its growth, is far more digestible than is the case when grain has been allowed to ripen in the straw, and a heavier crop may be harvested. If properly saved its feeding value is better, and it is much more palatable to stock.

In the city markets, chaff of bright green colour, cut from half an inch to five-eighths of an inch in length, will always command top prices.

Each reaper and binder should be followed by a sufficient staff of stookers to ensure prompt stooking of the sheaves, in order to prevent discolouration by moisture from the soil, and to bring them into the best position to receive the full effects of sun and air.

Not more than seventeen good-sized sheaves should be placed in each stook, so that sun and air may have free access right through them. When of moderate size, the stooks dry out more rapidly after rain, without the necessity of turning the sheaves.

The time necessary for curing will, of course, vary with the crop and the state of the weather, from eight days upwards usually being required.

Before carting to the stacks its condition may be tested by taking some of the hay from the middle of a stook, and breaking and rubbing it in the hands to ascertain its moisture contents. It is desirable that, as far as possible, bleaching shall be prevented by stacking promptly.

For instructions in building stacks, see article on "Harvesting Wheat and Barley."

Oats.

As it is necessary that oaten hay should contain a full supply of grain, the crop should be allowed to attain much more mature condition than is necessary with wheat. The best indication of a fit condition is when the upper tips of the heads turn white, the grain in the lower portion being then in the dough stage.

Algerian oats may be allowed to advance somewhat beyond that stage, as it has a tendency to make rather a bitter hay if cut on the green side.

It will, however, be found one of the most reliable varieties, as it thrives under dry conditions, and under most circumstances it will be found rust-resistant.

Good white varieties will be found in Colossal, Abundance, White Ligowo, and Great Northern.

For ensilage or feeding off these varieties will also be found successful and satisfactory, as their upward growth is more rapid, and they are sweeter in their earlier stages of growth than the Algerian.

Stooking should be carried out as advised in the paragraph on "Wheat," and every care should be taken that the carting and stacking are promptly carried out, so as to preserve the colour and the best fodder qualities of the hay, and to prevent loss of grain.

Lucerne.

The best time to commence cutting lucerne is when a fair proportion of the crop is in flower, as its nutrient value is then at its best, and the least loss in weight will ensue if the hay is properly saved.

The length of time allowed for drying in the field will, of course, depend on weather conditions.

When high temperatures prevail in dry districts, when the crop is cut with the mower it should be at once horse-raked into windrows, and in about twenty-four hours drawn into cocks by means of the horse-rake. In some cases, however, it will be ready to stack in that time. It is undesirable to allow it to lie behind the machines just as cut, as the drying process is so rapid as to cause loss of foliage in subsequemt handling.

The aim of the maker should be to get the hay into stacks with as little handling, consistent with proper curing, as possible.

In hot, dry weather the reaper and binder cannot be surpassed as an implement for cutting, as it is more economical in labour, and the hay may be saved with the minimum amount of handling.

Hay will dry thoroughly in sheaves; but care should be taken not to stook heavily, the best method being to stand the sheaves in rows not more than two deep. By this means practically no loss of foliage need occur, if no loss of time occurs in stacking.

Silos and Silage.

The Danger of badly made Silage.

A case has been brought under the notice of the officers of the Department of valuable horses having been killed through eating bad silage, which should serve to emphasise the necessity of great care being taken that at least some rudimentary knowledge of the subject be possessed before an attempt is made to either form a stack or fill a silo. The complaint emanated from Mr. G. A. Hubbard, of Mary Vale, near Wellington, and on investigating the matter the Acting Chief Inspector reported that the silage was made in a pit 50 feet long by 15 feet wide at top, and 9 feet in depth. Into this was chaffed about 30 tons of maize, on top of which was placed from 60 to 70 tons of lucerne not chaffed, the whole being covered with a good layer of soil. The filling was done in March, and occupied about five days. The silage was fed to sixteen cows for over three months, and they milked well on it. Mr. Hubbard also fed it to his sheep with good results. Upon opening the pit, Mr. Hubbard found that there was a considerable amount of waste at the sides and on the top, but that the greater portion of the silage was in excellent condition. At the time of the visit of the Chief Inspector the pit was nearly empty, but there was sufficient corn silage in it for him to be able to make an examination. It was found that after removing a few inches of the outer coating the maize silage was in good condition; it was a good specimen of sour silage suitable for dairy cattle or other farm stock. What was left of the lucerne had mildewed as the air had got into the top layer, and, therefore, any idea of what the quality had been could not be given.

Mr. Hubbard had fed the silage to his cows and sheep in a paddock. Into this paddock he put his horses, and they ate some of the silage. They soon showed signs of sickness, with fever in legs and feet, and lost the use of their tongues, and soon afterwards the use of their hind legs. Two of them died in a few hours and a third one lingered for three days. Three others which were lightly affected were turned into a crop of green wheat and eventually recovered. Mr. Hubbard tried drenching the horses, but without any good results.

The stomach of one of the horses was submitted to the Government Analyst who reported that he could find no traces of poison. A sample of the silage was also submitted, and on this Mr. Guthrie reported that chemical analysis did not indicate a poison present in the material, but the silage had been so badly prepared that it was mouldy when received, and quite unfit for food. The poisons present were due to the formation of moulds and ferments, and Mr. Guthrie added, "the material is not silage at all.'

From the foregoing there appears to be little doubt but that the deaths and sickness of the horses were due to the mouldy silage.

The Department has already published an exhaustive Bulletin dealing with "Silos and Silage," and any person in doubt as to the correct method of preserving fodder in this manner should apply for a copy of it.

Approximate Capacity of Circular Silos, in tons.

(Estimated on the basis of silage made from well-matured corn.)

Height of Silo.	Inside Diameter of Silo.						
	10 feet.	12 feet.	14 feet.	15 feet.	16 feet.	18 feet.	20 feet.
feet.	tons.	tons.	tons.	tons.	tons.	tons.	tons.
20	26	38	51	59	67	85	105
21	28	40	55	63	72	91	112
22	30	43	59	67	77	97	120
23	32	46	62	72	82	103	128
24	34	49	66	76	87	110	135
25	36	52	70	81	90	116	143
26	38	55	74	85	97	123	152
27	40	58	78	90	103	130	160
28	42	61	83	95	108	137	169
29	45	64	88	100	114	144	178
30	47	68	93	105	119	151	187
31	49	70	96	110	125	158	195
32	51	73	101	115	131	166	205

In calculating the capacity of rectangular silos, 40 lb. may be taken as the average weight of 1 cubic foot of corn silage. One ton of silage will accordingly take up 50 cubic feet, and 100 tons, 5,000 cubic feet. If a rectangular 100-ton silo is to be built, it may be 12 x 14 feet and 30 feet high, or 12 x 12 x 35 feet, or 13 x 13 x 30 feet.

Silage weighs from 30 to 50 lb. per cubic foot. Good corn silage averages about 35 to 40 lb. Clover and cowpeas silage weigh more than corn silage. One acre of corn should yield from 10 to 15 tons of silage, and 1 acre of clover, vetch, cowpeas, rye, &c., should yield from 8 to 10 tons of silage.

Importation of Live Stock into the Philippine Islands.

THE Minister of Agriculture, in August last, received from the Commercial Commissioner for New South Wales in the East, particulars of Rules and Regulations for the inspection and shipment of live stock, issued by the Bureau of Agriculture at Manila, and they were printed in the *Agricultural Gazette*, of September, 1908. A communication has now been received from the American Consul-General, forwarding a further General Order No. 12. This order would seem to establish the rules governing the importation of live stock into the Philippine Islands in the event that they are found to be infected with anthrax, rinderpest, foot or mouth diseases.

The Order is as follows:—

1. Whenever any domestic animals, as defined in section 1 of Act 1760, arrive in a port of the Philippine Islands from any foreign port and are found to be infected with or exposed to any dangerous communicable disease, as defined in section 2 of Act 1760, such animals will be prohibited from landing, except as hereinafter provided.

2. Imported animals found to be infected with or exposed to anthrax, on arrival in any port of the Philippine Islands will not be allowed to land, but must be taken, with all effects pertaining to them, beyond the jurisdiction of the Philippine Islands.

3. Whenever any domestic animals, arriving at the port of Manila from any port, are found to be infected with rinderpest, or foot and mouth disease, the Director of Agriculture will grant special permission for the discharge of any or all of such animals from the vessel or vessels on which they arrive, into suitable vessels or lighters on which they may be held at the port of Manila, under the supervision of an authorised representative of the Director of Agriculture, until such time as they may be exported or slaughtered, as hereinafter provided.

4. Any vessel or lighter, or any other form of water craft to which animals are transferred, as provided in section 3 of this rule, will be regarded as a quarantine corral, and subject to the rules and regulations governing same; provided that no animals held in quarantine on such vessel, lighter, or water craft, will be permitted to land, except for immediate slaughter, until the expiration of the minimum quarantine period required under the provisions of section 1 of rule 1, General Order No. 10.

5. The Director of Agriculture will allow animals, so held in quarantine at the port of Manila, to be landed at a point designated by him, as near as practicable to the municipal slaughter-house, and to be conducted by the shortest possible route, to be approved by him, into such slaughter-house, and to be killed immediately. The carcases of such of them as are diseased and are unfit for human food at the time they are killed must be immediately transported to the city crematory and burned.

6. The Director of Agriculture will refuse to permit the transfer from the ship or vessel on which they arrive at the port of Manila to any other vessel, lighter, or other form of water craft, or to the shore, of all animals hopelessly ill with any dangerous communicable disease, or suffering from such disease to such an extent as to render them unfit for human food; provided that the Director of Agriculture will, in his discretion, authorise the killing of such animals on the ship or lighter, and their immmediate transfer to the crematory where they must be immediately burned.

7. Landing privileges similar to those authorised in sections 3, 4, 5 and 6 of this Rule will be extended to animals arriving at other ports of entry in the Philippine Islands, whenever such ports provide suitable slaughter-houses, approved by the Director of Agriculture, in which animals may be conveniently landed and killed without danger of spreading infection.

This Order shall take of effect immediately upon its approval by the Secretary of the Interior.

G. E. NESOM,
Director of Agriculture.

Approved, November 2, 1908.
DEAN C. WORCESTER, Secretary of the Interior.

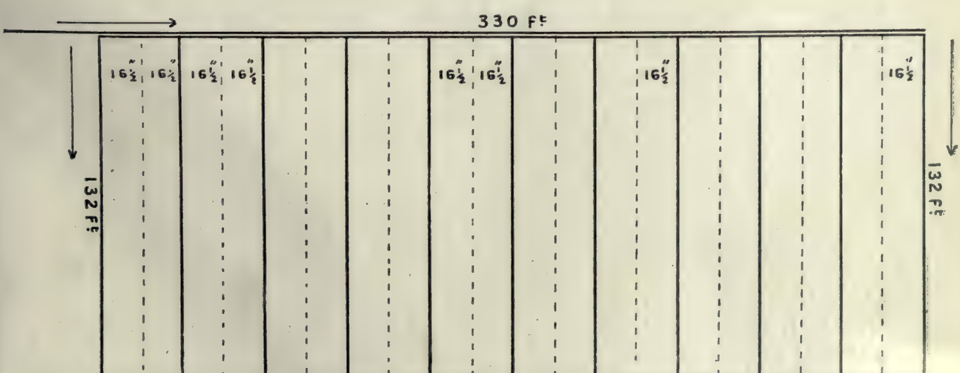
Utilisation of Waste Water from Butter Factories.

W. J. ALLEN, Fruit Expert.

THE question of making use of the waste water from factories is one which from the producers' point should be worthy of consideration. There are many butter factories situated in dry climates, the waste water from which could with advantage be utilised for the growing of crops of vegetables, sorghums, corn, lucerne, &c., as with the aid of from 6,000 to 12,000 gallons a day (the quantity of water running to waste in many of the factories, I am told), several acres could be given sufficient water to ensure good crops; or if it was simply a question of getting rid of the water to prevent it becoming a nuisance, it could be turned on to a small area daily, and the whole ground worked up to a good depth occasionally, or before it became offensive.

If corn, sorghum, tomatoes, cabbages, cauliflowers, &c., were grown they could be planted in rows from 2 to 3 chains long, and the water turned into furrows between each row, and allowed to run until the soil was well saturated to a depth of at least 2 feet and up to the roots of the plants. After each such soaking the ground should be broken up with either a Planet Jr. cultivator or a fork hoe.

If the water was used for lucerne growing, it would be well to have the land well levelled before sowing, leaving a fair fall in one direction, then divide the area up into small lands $16\frac{1}{2}$ feet x 132 feet. For instance, if there were 6,000 gallons of waste per day, that would be sufficient to thoroughly saturate about $\frac{1}{20}$ of an acre, or if twice that quantity of waste, then $\frac{1}{10}$ of an acre. The land might be laid out as shown in the following sketch of an acre laid out as described, and which may be of some use as a guide.



The block is 330 x 132 feet, and the water runs in the direction indicated by the arrow. If the soil is not very porous the water might run the whole length (132 feet) without any subsidiary channels, but if it were very light or porous soil or without much fall, it might be well to run a little channel a distance of about 100 feet down between every other block. It will be seen that the acre is divided into twenty strips of a width of 16½ feet, and the heavy lines between every other block indicate where, if it is necessary, subdividing channels may be put. I am assuming that the land is so graded as to enable the operator to run the water out on either side of the latter channel. The channels would require to be about 1 foot wide at the top and 4 inches deep. This would be quite large enough for the top 330 feet or the subsidiary ones. There should be a slight rise at the outside boundary of each 16½ feet block so as to enable the operator to keep the water confined to each individual block daily. If the flow were 12,000 gallons daily that would be sufficient for two blocks, or 33 feet x 132 feet. It would be necessary to take a look at the water occasionally just to see that it was spreading evenly over the land. If any of the other crops I have mentioned were to be grown, they should be planted in rows 132 feet long, and the water could then be turned into furrows made between the rows and allowed to run in same until it was well soaked the whole length before turning it off and into adjoining rows.

Seeds of Native Grasses.

Applications for seeds of our native grasses are continually being received by the Department of Agriculture. Two of the latest applications are from Japan and the Transvaal.

The Transvaal Department of Agriculture reports that for some years past they have been experimenting with our grasses ; that, so far, they have been unable to purchase these seeds in quantity, and that as they have obtained such excellent results they are anxious to arrange for their collection in bulk. They offer to pay up to 5s. per lb. for the following species in the quantities given, viz. :—

Mitchell grass (*Astrebla triticoides*)	100 lb.
Blue grass (*Andropogon sericeus*)	100 lb.
Silky-heads (*Andropogon bombycinus*)	25 lb.
Australian millet (*Panicum decompositum*)	25 lb.
Rigid panick grass (*Panicum prolutum*)	25 lb.

The Department of Agriculture of this State is also anxious to obtain seeds of our best native grasses in quantity. Offers of seed should be made to the Under Secretary, who would also be pleased if pastoralists and farmers would advise him of places they know where these seeds could be fairly easily collected in quantity.

Lime and Whitewashes.

The following recipes, which can be recommended, are given in response to various inquiries which have lately reached the Department.

A cheap whitewash, which will stand the rain and weather without coming off, and will do for galvanized iron:—Place enough tallow required for the purpose in a large bucket; then lay about the same quantity of good lime (dry) on top of tallow—*i.e.*, equal proportions of each; then pour enough water on to slake the lime. When the heat from the lime has melted the tallow, and all is well dissolved, stir it thoroughly until all is well mixed, then apply (warm, if possible) with a large brush. This will do for any surface. The surface must be quite dry before applying the mixture. If required to dry very white, add a small quantity of blue.

Whitewash for Outside Work.—Take a clean, watertight barrel, and put into it half a bushel of lime; slake it by pouring water over it boiling hot, and in sufficient quantity to cover it 5 inches deep, and stir in briskly till thoroughly slaked. When the slaking has been effected, dissolve it in water, and add 2 lb. zinc sulphate and 1 lb. common salt. These will cause the wash to harden, and prevent it cracking. Common colouring is prepared by adding earthy pigments to the mixture used for lime-whiting (which is white-washing of hot, pure white lime and water, improved by adding 1 lb. of tallow free from salt to every bushel of lime). The following (approximately) are the proportions of colour to every bushel of lime, according to tint required:—Cream colour, 4 lb. to 6 lb. ochre; fawn colour, 6 lb. to 8 lb. umber; Indian red, 2 lb. lamp black; buff or stone colour, 6 lb. to 8 lb. raw umber and 3 lb. to 4 lb. lamp black.—*Western Australian Journal of Department of Agriculture.*

A cheap limewash paint, which is thoroughly adhesive, and will reduce the temperature of a building if applied to the outside of galvanised-iron roofs or walls, can be made as follows:—Break up 1 lb. of glue, and soak for twelve hours or more in plain cold water; then pour a kettle of boiling water on it in a kerosene tin, and place it on a slow fire to melt. Meantime, take 1 lb. alum, and melt it with hot water. Also take 10 lb. fresh lump-lime, and pour cold water on it to cover it well, and, while the lime is slaking and boiling, add the alum and then the glue. Stir well. If more water is required, add it hot, keeping the mixture stirred, and thin out like milk. This will make about 10 or 12 gallons of wash, according to the quality of the lime. The sooner the wash is used after making the better.

Limewash for Outside Work.—The United States Government use the following formula for their public buildings, lighthouses, &c.:—

Quick-lime ...	2 pecks.	Spanish whiting ...	½ lb.
Common salt ...	1 peck.	Glue (white) ...	1 lb.
Rice flour ...	3 lb.	Water	Sufficient.

Slake the lime, strain and add the salt (dissolved in warm water); boil the rice-flour in water, soak the glue in water, and add both with the whiting and 5 gallons of hot water. Stir all well together, and allow to stand for five days, when it will be ready for use. Apply hot.

This is more complicated than the others, and it is considered that the first recipe given should be as good as any.

The Onion.

E. D. BUTLER, Department of Agriculture.

THE onion (*Allium cepa*) is one of the oldest vegetables of European gardens, and away back in remote ages it grew wild over great tracts of Asia. The ancient Egyptians cultivated it, and to-day it is a valued crop and a vegetable that is much relished. It is one of the most profitable crops that can be grown; there is no heavy labour attached to its cultivation, and quick active boys can do all that is required in this direction. Another point in its favour is that, unlike most other crops, it does not exhaust the soil or require that the land be rested at intervals, but yields heavy crops year after year. As a matter of fact, many experienced growers make it a point that once the onion-bed is prepared it is kept in a fine state of tilth and free from weeds, for weeds are one of the greatest obstacles to successful onion-growing.

The quantity of onions imported into this State annually is enormous, considerable cargoes having only recently arrived from Japan and America. Victoria is also a large contributor. This demonstrates the fact that the quantities grown do not meet the demand of our market. With our varied soil and climate there should be a much greater extension of onion cultivation, for it is a crop that will yield substantial profits under the best treatment and suitable conditions. There is always a large demand for these bulbs, and it is likely to increase with our growing population.

Soil.—To grow onions successfully and extensively, much care should be taken in the selection of the land. Certain districts, such as the Hunter River and around Wellington, have been noted for onion-growing, but there are numerous other localities well adapted for the crop. Many kinds of soil can be brought into the desired state for onion culture, but it is a question of how far the expenses incurred will leave a margin of profit. The main consideration is to obtain a suitable soil; it should be a moderately light loam, deep, well drained, and fertile, and which can be readily worked, mellowed and cleaned, and rendered firm without becoming consolidated. The onion will also grow to perfection on chocolate soil. Fairly heavy or clayey black soils, if not too tenacious, produce an onion of strong skin, great substance, and firm flesh, an onion that, as a rule, stands well the handling in transit to market. Unquestionably the prospect of successful culture of this vegetable on very heavy land is a poor one and much too risky a speculation to be recommended. Soils with an abundance of decomposed vegetable matter will be found eminently suitable. The situation of the land must be open and sunny, and should be fairly free from weeds, so as to avoid expense in cleaning.

Preparation of Land.—It is a great advantage to get the land ready as early as possible, so that any weeds which appear can be rid of and much subsequent labour thus saved. The land should be ploughed as deeply as the subsoil will permit. The character of the soil should determine the proper depth of ploughing. If the land is loose, rich, and friable, ploughing to a depth of 10 to 12 inches is recommended; there is little danger of ploughing too deep. It is not desirable to turn up a stiff heavy subsoil in preparing ground, for this invariably diminishes the yield, renders cultivation more difficult, and requires more frequent tilling. Frequent cross cultivation and harrowings are essential to reduce the soil to a firm tilth; the finer the tilth the better for weeding and hoeing. The soil cannot be too fine for the reception of the seed, and must be firm with the roller, for that condition is requisite to ensure the proper development of the bulbs. A disc harrow is almost indispensable if clods and lumps are numerous. The roller and this implement may be used alternately with advantage. Soils which are stiff and heavy and are deficient in fertility may be greatly improved by growing and ploughing under cowpeas. The effect of such treatment is to enrich the soil, make it loose and friable, and free from many weed seeds. Corn or potatoes is a good crop to precede onions.

Seed and varieties.—It is a most essential point to obtain fresh, reliable seed true to name. Onion seed loses its vitality very quickly, and seed from not earlier than last season's crop should therefore be procured. It is impossible to secure satisfactory results without seed of superior quality. Growers sometimes make the mistake of purchasing seed of uncertain vitality because it is cheap. A good plan to determine the vitality is to place some of the seed in a moistened cloth, put it in a shallow dish, and note the number germinating. Many experienced growers invariably save their own seed, for by selection and judicious cultivation through a series of years it is possible to raise the standard of excellence. To do this large, well matured, evenly formed bulbs of the respective varieties should be selected and carefully stored each season and planted out in the following season in rows about 3 feet apart, stakes being placed to each bulb to secure the heads from being blown and knocked about and probably broken by the wind. If the season is favourable—that is, dry and hot—a fair amount of well ripened seed should be obtained.

Promptness in harvesting is essential, for if delayed too long the seed receptacles open and part of the seed will be lost in handling. When the tops turn yellow remove them with about 6 inches of the stem, and place them in strong paper bags, and hang up in a well-ventilated place to dry. Frequent turning will hasten the drying, and most of the seed will drop out in the operation. Any seed remaining can be beaten out with a flail and cleaned by winnowing. The seed should be stored in a well-ventilated place free from excessive moisture.

In other cases it might be possible to secure the seed from a neighbouring grower, whose stock is known to be good and suited to the district. Where

this is not convenient or possible the seed should be obtained from a reliable seedsman, and thus avoid getting mixed sorts, and finding one part of the crop ripening before the remainder.

The number of varieties of onions is very considerable, and among the recognised types are Silver Skinned, Extra Early Globe, Yellow Globe, Crimson Globe, Brown Spanish or Portugal, James' Keeping, Giant Rocca, Lemon Rocca, Flat Italian Tripoli, and others.

Being one of the earliest, Extra Early Globe is recommended for early crops. It is a fine well shaped globe onion, small in the neck and a heavy cropper. It is ready for market three or four weeks before any other sort, and has a hardy and good skin. Brown Globe is a good strain, and coming in between early and late kinds is suitable for second crop. It is a good cropper, and has a solid flesh, good colour and skin. Brown Spanish or Portugal is without doubt the best late onion in cultivation. It is of handsome shape and appearance; has a skin of deep brown colour and white and solid flesh. It stands well the handling of transit, and is unequalled for storing. Many other varieties will be found suitable for the various soils and differences of climate. Varieties should be selected which contain desirable characteristics or command the highest price in the market. The best type for general purposes should be nearly globular in form, hard and compact in structure, and mild and sweet in flavour, fine skin and small neck, and medium size. The time for sowing the seed will, of course, vary accordingly as the district in which it is proposed to plant is an early or late one. In the coast districts, May and June are the best months, but inland the late sorts might be sown in July and August. However, the proper time can be determined with very little experience, and a good plan is, of course, to follow the practice of successful growers in the locality.

Sowing and Cultivation.—The ground, having had a thorough course of preparation, should be rolled and firmed for the reception of the seed, otherwise the plants will run to neck and leaf, and, while maintaining a firm soil, the grower may with advantage maintain a mulch on the surface by the movement of the hoe in keeping down weeds. Though broadcasting is still practised, sowing in drills is increasing in favour; the latter system is recommended. The seed should be drilled to a depth of about 1 inch, 4 to 6 inches in the rows, and the rows 9 to 12 inches apart; these distances will admit of efficient weeding operations. It is an important matter to have straight rows, with a uniform difference between them; it will add to the attraction of the field and facilitates the use of the wheel hoe. A line may be stretched as a guide by which to drill the first row; if the spaces become irregular as the operation proceeds, the rows should be straightened by means of the line. A few days after sowing a light harrowing might be given. To keep down weeds successive harrowings should be made as required in the same direction as the rows, but in about three weeks the seed will germinate, and harrowing should then cease. The after cultivation required is to keep the ground free from weeds; keep the surface well stirred so as to form a mulch to prevent evaporation, especially after rain, to prevent the formation of a crust.

The quantity of seed required per acre, if drilled, is from 2 to 3 lb., and from 4 to 6 if broadcasted. Transplanting is greatly favoured by some growers, and if this method is adopted the plants should be transplanted from the seed-bed to the required distances when about 4 inches high. The first leaves generally die away, but if planted in cool moist weather the plants will soon become established.

Harvesting.—Onions take from six to seven months before reaching complete development. Bending over the stems is a great aid to ripening. When the tops have withered and are dry and crisp, the bulbs should be lifted; the plants are simply pulled by the hand and placed in windrows containing the onions from three or four rows. In order to effect curing they should be allowed to remain in the sun for about five to seven days, the length of time depending on the weather, but great care should be exercised so as not to allow them to scald. If the weather is wet it may be desirable to take the bulbs under cover, spreading them out in an open dry shed and turning them occasionally. Some growers adopt the method of bunching and suspending them. Before bagging, the tops and roots should be trimmed. Sheep-shears can be used to advantage in this work leaving about an inch of the top on the bulb. Great care should be taken not to bruise any of the bulbs, for decay sets in quickly. Gunny bags are the best to use, as affording greatest ventilation.

Diseases.—Perhaps one of the most destructive enemies to this vegetable is the Onion maggot (*Phorba ceparum*). The maggots come from the egg deposited on the plant, and require about a week to hatch, the larvæ burrow into the bulbs and remain about two weeks, then emerge and pupate in the ground. The first indication of their presence is the tops turning yellow in colour, then withering, and finally dying before the bulbs have matured. It is difficult to suggest a remedy, but liming the soil is found to be beneficial. If the infestation is very severe, rotation of crops should be tried.

Another disease to attack the onions is Onion smut (*Urveystio cepulae.*) It attacks the young plants, causing dark spots on the leaves. As the onion develops these spots crack open, exposing a black powder which contains the spores of the fungus. If very severe it causes the tops to die, and often spreads to the bulbs. If the disease shows signs of spreading all infected plants should be pulled up and burned at once. Dusting with lime is recommended. All tops should be burned after harvesting. Rotation of crops is the most effective remedy.

Seasonal Notes.

Controlling the "Black" Oat Pest.

GEO. L. SUTTON, Wheat Experimentalist.

The "wild" or "black" oat (*Avena fatua*) has increased to such an extent in the cultivation paddocks of our settled wheat districts, that the question of how to control it must now be very seriously considered. So serious is the pest in some districts, that a correspondent considers the discovery of a method of controlling it as important as the production of new and improved varieties of wheat.

Many farmers held the opinion that it cannot be controlled without allowing the paddocks to go out of cultivation. Whilst this may be the case with some methods of cultivation, it is not true with all methods, as is conclusively proved by the absolute freedom from "black" oats of the past season's crops at the Cowra Experiment Farm. It is not certain that allowing the "dirty" paddocks to go out of cultivation will control the pest, or indeed do anything but afford temporary relief from the trouble. It is recognised that the seed of the wild oat has remarkable vitality, and that it will germinate after lying dormant in the ground for several years. The pest is therefore likely to appear, probably to some extent lessened, when the paddocks are again brought into cultivation.

As the "oat" pest is a constant, and will always be a recurring evil, the only satisfactory and effectual way of dealing with it is to adopt methods of cultivation which regularly control and keep it in check. Fortunately the methods that will do this are the careful methods which will also produce the most profitable crops. This has been proved by the results at the Cowra Experiment Farm during the past four years. The past season's crops were quite free from "black" oats. This desirable state was not due to the fact that the land was clean to commence with, or that special precautions had been taken to keep it clean. Beyond taking the precaution to remove any "oat" seed from the wheat seed which was to be planted, no precautions were taken to deal with the pest. The fact that the paddocks are clean is an incident due to the methods of cultivation adopted. The clean state of the crops will appear the more surprising to some farmers when it is stated that the working horses have been regularly fed upon oaten (Algerian) chaff. The first crops were full of "black" oats and other weeds, largely the result of the farm site being originally part of the town common, for in consequence the land was full of weed seeds through stock of all kinds, and which had been fed upon all classes of fodder, having grazed upon it.

That the cultivation paddocks at the Cowra Experiment Farm were clean was noticed and commented upon by the members of the local branch of the Farmers and Settlers' Association when visiting the farm in October last.

Some of the farmers present were inclined to doubt that the "black" oat could be controlled so thoroughly by the usual methods of good farming, and without special precautions being taken to deal with it. In order to demonstrate whether or not the "oat" could be controlled, in what time, by what methods, and at what cost, an offer was made to allow the Association to plant a block of 12 acres with seed of the "black" oat as soon as the then growing crop of wheat was harvested.

The block offered for the test is particularly suited for one of this character, for it is divided into plots, some of which are regularly ploughed with the disc plough, others with the mouldboard plough at different depths ranging from 4 to 8 inches. It will therefore be possible to see whether one type of plough or one depth of ploughing is more effective in controlling this pest than another.

The treatment the block referred to will receive, whether the "oat" seed is planted or not, is as follows :—During the present autumn it will be cropped with rape, which will be fed off with sheep before the end of September. In October the block will be thoroughly ploughed and will be fallowed during the summer. During the summer, and until planting time in May, the fallow will be worked 2 to 3 inches deep in order to conserve moisture and destroy weeds. In May, 1910, the wheat will be planted after the land has been cultivated, and without reploughing.

The offer made to allow "black" oats to be introduced on to a clean farm shows that considerable confidence is felt in the ordinary methods of farm practice to control the pest. Little doubt is felt, and if the offer is accepted and the "oat" seed is planted, that the next crop of wheat in 1910 will be as clean as the one the members of the Association examined in October, 1908.

To control or reduce the black oat in next season's wheat crop, the following recommendations are made :—On land that is being fallowed the weeds should be kept down by stock, and should eventually be killed by thorough cultivation or by skim ploughing. On land that is known to be "dirty," the planting should be delayed and the cultivation continued until as late as it is safe to plant for best results. The ground should not be reploughed immediately before planting. To plough just before the wheat is planted is a mistake often made when dealing with this pest. This procedure, though performed with the object of doing what is right and proper, very often undoes the good work of cultivating and cleaning the fallow. Many seeds which had been lying dormant, because they were buried too deeply to germinate, are, by ploughing, brought near the surface; and under conditions favourable for germination, in consequence, they germinate at the same time as the wheat, with a resulting "dirty" crop.

Ground that was cropped last year, and which is to be again cropped this year, should be ploughed and broken down as soon as possible, so as to encourage the weed seeds to grow, for it is practically impossible to destroy the seeds, but easy enough to kill the young plants. It should then be treated according to the plan recommended for fallowed land

The effect of cultivating the fallow will be not only to clean the land but also to increase the yield of the succeeding crop of wheat; farmers need not hesitate to work their fallows fearing that it will not pay. Results also conclusively show that it is better to plant late on well prepared land than early on land badly prepared.

Another way of dealing with land foul with "black" oats is to plant it early with a quickly maturing variety of wheat, and to make either hay or

ensilage of the crop. To transform the crop into silage is by far the better plan, for in addition to providing succulent food which, to the stock breeder, is far more valuable than dry hay, ensilage will destroy any weed seeds that may be present in the crop, whilst they will be preserved in the hay. Varieties like Comeback, Firbank, and Bunyip are excellent for this purpose; if planted early, they will be ready for hay or silage before the "black" oat matures and sheds its seed, and can be dealt with before the main harvest commences.

Rape.

This is one of the best rotative crops, suitable for our wheat districts, and should be largely planted in them. The majority of our wheat growers have not yet realised the possibilities nor the value of this plant; when they do, the acreage planted will enormously increase.

It is seasonable to sow rape towards the end of the month. The usual plan is to sow it broadcast, but a decided advantage over the usual plan is to sow it in drills about $2\frac{1}{2}$ to 3 feet apart. When planted in this way, the crop can be intertilled—*i.e.*, the ground between the drills of rape can be cultivated. This cultivation is not an expensive operation, for it can be done with a harrow when the plants are small; and with a large cultivator, covering two to four drills, when the plants are more advanced. In a dry district, the advantages of planting rape in this way are very great; in fact, so great as sometimes to make the difference between success and failure with the crop. The cultivation between the drills conserves the moisture, destroys the weeds, and stimulates the growth of the crop by ærating the soil and liberating dormant plant food.

Rape can be sown in the way indicated, and the required distance apart, down the tubes of an ordinary wheat drill if the usual seed chambers on the drill are replaced with ones containing discs which have shallower recesses.

Three pounds of seed per acre will be sufficient to sow. With the seed, about 56 lb. superphosphate should be drilled in. Even on rich soils this fertiliser has a marked beneficial effect.

Last season some difficulty was experienced with aphis infesting early sown crops of rape, so that stock showed reluctance to graze them after they had been infested. The most successful way of minimising this trouble is to keep the rape crop constantly eaten down until the cool weather sets in when the trouble from the aphis will cease.

Ploughing.

Unploughed land intended for next season's wheat crops should be broken without delay. In some districts the recent rains will facilitate this work. The advantages of early ploughing cannot be too strongly emphasised, for it may mean all the difference between profit and loss. A case of this kind was brought under my notice when recently in the Trangie district. From one portion of a paddock, 8 bushels of wheat per acre were obtained; on the other part of the same paddock the crop was a failure. These varying results were apparently due entirely to the fact, that when portion of the paddock was ploughed, 63 points of rain fell; on the portion which was ploughed when the rain fell 8 bushels per acre were stripped, on the other portion the crop failed. Had the whole paddock been ploughed early and before the rain, there is every reason to believe that 8 bushels would have been obtained from the whole paddock instead of from only a portion of it.

Orchard Notes.

W. J. ALLEN.

February.

Fruit Fly.—The absence of this pest from our orchards this year has made the life of the fruit-grower very much easier, and the neighbouring States need have very little fear of introducing this pest with any fruit which they may import from this State, as the fly has practically disappeared. In order to prevent its reappearance, however, our growers must continue the work of picking up and destroying (by boiling or burning) of all fallen or infested fruit. If this precaution is strictly carried out, I do not anticipate much more trouble from this unpopular visitant.

Codling Moth.—Continue to fight this, the greatest enemy of the apple-grower, as it is only by united action on the part of the apple, pear, and quince growers that we may ever expect to conquer it. Those who have sprayed with arsenate of lead (Swift's) or arsenite of soda, two or more times, and attended to the bandages regularly, report a light percentage of damaged fruit. We still, however, have a number of careless and neglectful growers, who are a menace to their neighbours, and who, by a neglect of these precautions, give the Inspectors considerable worry. A good many of these neglected orchards are being weeded out; but there are still scattered orchards which, if they do not receive more systematic attention from the owners or occupiers, will have to be uprooted, as it is the intention of the Department to help the growers in every way possible to fight, and, we hope, to practically wipe out this pest; but this cannot be accomplished while we have growers who bury their infested fruit, or fail to comply with the regulations under the Act. We hope, therefore, that not only will the fruit-growers' unions do all they can to see that every grower does his duty, but that the growers themselves will, when they know of negligence in their neighbourhood, either notify the Department or the local Inspector.

The Orchardist at Bathurst gives the following progress report up to date of this season's treatment for codling moth. Four applications of Swift's arsenate of lead, of a strength of 4 lb. to 100 gallons of water, were applied to the following varieties on the dates mentioned:—

	Oct.	Nov.	Nov.	Dec.
Cleopatra ...	21	4	25	17
Granny Smith	21	5	25	16
Rome Beauty	29	5	25	16
Jonathan ...	29	5	26	17

The bandages on them were examined five times, and the fruit on the trees six times. In the bandages have been found :—

74 grubs in Cleopatra,	84 grubs in Rome Beauty,
30 ,, ,, Granny Smith,	182 ,, ,, Jonathan.

From the trees the following infested fruit was removed :—

269 from Cleopatra,	166 from Rome Beauty,
413 ,, Granny Smith,	454 ,, Jonathan.

Taking the four varieties, the crop average is, at present, approximately $2\frac{1}{4}$ bushels per tree.

Perfection has never been sprayed, and with grubs in the bandages and infested fruit, 1,186 have been found. These results speak for themselves, and will be a guide for our future work.

Systematic spraying, not using second-hand cases, bandaging, and last but not least, thorough hand-picking, will, I believe, help the growers to keep the moth within 5 per cent.

Fumigating and Spraying for Red and other Scales.—While this is considered one of the best months for carrying out this work, under no circumstances should the work be done if the trees are out of condition from lack of moisture in the soil, as a tree suffering from drought or want of cultivation can easily be damaged by either spraying or fumigating them. This latter work should be carried out at night, and spraying on cool days, in the early morning or late in the afternoon, avoiding all hot days. Leaflets on either spraying or fumigating may be had on application to the Department of Agriculture.

Never fumigate after the trees have been sprayed with Bordeaux mixture, but there is no danger in spraying with the Bordeaux after fumigating.

Deciduous trees infested with San José scale may be sprayed with the resin, soda, and fish-oil solution as soon as the crop is harvested, or any time now.

Irrigation.—Wherever irrigation is practised, see that the trees and vines are given a good soaking if they require it ; but in most cases during normal seasons vines should not require any further watering, as, in the case of raisin-grapes, it would retard the ripening period, which is precisely what we wish to hasten. It may help dessert varieties, intended for marketing late in the fall or early winter. In every case where trees or vines are watered, see that the land is thoroughly cultivated immediately it is dry enough to work.

Budding.—The early part of the present month is the best time to bud to better varieties all poor and worthless varieties of fruit-trees found growing in the orchard. Do not allow an unprofitable tree to remain there another year. Be sure that the buds used are taken from trees that have borne the very best quality of fruit, and do not forget that in the case of peaches the good canning varieties always find a ready sale at remunerative prices.

Green Manuring.—Towards the end of the month arrangements should be made for sowing crops such as are required for green manuring; and as the fall and winter are the only seasons when such crops can be grown among the trees without robbing them of moisture, it is best to sow only such varieties as will make a fair growth during the cooler and cold months. Such crops as grey field-peas, tares, rape, rye, &c., are depended on to furnish nitrogen and organic matter to keep the soil in a proper state of fertility.

Export of Apples.—Fruit intended for export will be ripe enough for picking and packing towards the end of this month or early in March. To those who intend exporting I would emphasize the necessity of sending only the best fruit. It should be well-coloured, either red or yellow, of good size, evenly graded, neatly wrapped, and firmly packed. The fruit should be picked and handled carefully, in order to avoid bruising, and should be kept as cool as possible from the moment it is taken from the tree until it is stored away in the boat which is to carry it to Europe.

Use good, strong, clean cases for holding the fruit, and have them stencilled neatly and legibly, as anything is not good enough, but only the very best.

NOTE.—Wherever Swift's arsenate of lead has been used I have not heard of any damage to either foliage or fruit, but have had several complaints where growers have tried to make their own, by using acetate of lead and arsenate of soda, &c. Wherever the latter is used it would be well to add lime, and test a few trees before doing the lot.

District Notes.

HAWKESBURY.

H. W. POTTS, Principal, Hawkesbury Agricultural College.

THE keynote of the month's operations must be preparation for the winter and spring crops. Little can be done in the way of planting unless the much-needed rain falls. The last two Februaries have yielded us satisfactory showers, and, twelve months ago, the precipitation was sufficient to justify the sowing of considerable areas of maize, sorghum, and millet, with eminently satisfactory results. At any moment we may be similarly favoured, and the judicious farmer will have his ground ready.

Maize.—The outlook at the time of writing is ominous. The record heat-wave of the opening days of the year, though of short duration, played havoc with the maize crops of the district, and all the earlier sown ones must be cut for green feed or ensilage. In a large number of cases the stalks and flag have become quite dry, and if made into ensilage, care should be taken to sprinkle water while stacking, or after chaffing, to ensure sufficient fermentative action. The later plantings may yet be productive should the weather change.

All sowing had to be suspended during January; but up to the middle of this month it is well worth the risk of planting some of the standard varieties, such as Red Hogan or Hickory King, for green feed and ensilage, if the ground becomes moist enough to germinate the seed. Satisfactory results followed this plan last year, especially as there were no frosts till comparatively late in the season.

Sorghum.—Next to maize as a bulky fodder worthy of trial at such a juncture is sorghum, especially the quickly maturing Early Amber Cane. If the ground is well prepared, it may be sown on the first appearance of rain, and kept constantly cultivated until it has got over the early stages of growth, after which it is quite hardy and can safely be left to itself. Under existing circumstances, planting in drills is preferable to broadcasting. Apart from the bulk of succulent fodder it produces, its ability to remain green long after frosts have wilted other growths, makes it a great stand-by for the stockowner.

Millets.—These should not be neglected if suitable ground is available, and the weather proves in any way propitious. Both the Hungarian and the White French have been tried here with gratifying results, especially the former. Their powers of rapid germination and growth make them worthy of trial, especially where early frosts are not troublesome.

Potatoes.—The last crop was unsatisfactory, and, in many cases, failed to provide sufficient tubers for seed. Where conditions are favourable, the autumn crop may be planted before the end of the month. Early Rose and Bliss's Triumph have done best with us, while Brownell's Beauty has failed to equal the others as an autumn crop.

Rape.—Where pigs or sheep are kept, no better winter feed can be found than rape, and sowings may be made at the close of the month on well tilled soil. Drilled 2 feet apart, at the rate of 4 or 5 lb. per acre, or broadcasted with about double that quantity, under average conditions, a heavy yield of succulent fodder may be expected. As a winter soil-renovator, where legumes do not flourish, it has few equals.

Turnips.—The close of the month may be selected as a suitable time for the first sowing, though March stands pre-eminent as the best time in this district. No pains should be spared to get the ground into good condition. They are best drilled on the flat, or in ridges 30 inches apart, at the rate of 2 lb. per acre, and constant loosening of the soil is desirable.

Cereals.—The main crops for the spring harvest must now receive consideration, and every effort should be made to prepare for next month's sowings.

Lucerne and Grasses.—Similar attention is needed for areas designed for these crops, as a good seed-bed is absolutely essential to ensure a successful stand.

Cabbages.—Where these are grown on any extended scale, and last year several local farmers were wonderfully successful in this direction, a succession of sowings may be made in the seed-bed at short intervals, preparatory to planting out next month, in order to catch the climatic conditions favourable to transplanting.

Glen Innes.

R. H. GENNYS, Manager, Glen Innes Experiment Farm.

The general harvest will now be nearly over, and crops, it is hoped, safely in sheds or well stacked. The threshing machine and chaffcutter will soon be at work.

The necessity of using Good Seed.—Farmers are strongly advised to keep some of their very best seed for this year's sowing, and, if possible, to grade this. Our Department has pointed out, over and over again, the fallacy of sowing inferior seeds of any plant, and the point cannot be too strongly emphasised. It will always pay to sow the very best procurable, bad seed being dear at any price.

Chaff and Straw.—The cocky chaff after threshing should not be thrown away, as, with bran or molasses, it will help the cattle or other stock to pull

through the winter. Straw too, both wheaten and oaten, can be used in the same way, and also for bedding, to keep the animals warm, and absorb the liquid and most valuable part of their manure, which will keep the land fertile, and save expensive artificial fertilisers. The value of straw is not half understood; and do not burn the stubble straw standing in the field, but either eat it with sheep and tread it down, or plough it directly into the soil. Burning destroys the organic matter so much needed in most of our lands.

Cultivation.—Generally, most paddocks may now be turned over—deeply, for first ploughing or fallowing, is our rule—letting the land lie roughly exposed to the air, to sweeten and moulder down, so that, later, that fine, lively state of tilth may be obtained, so desirable for the healthy growth of young plants. Where many weeds or organic matter are to be buried, the mould-board ploughs will be found the best, and, from experience, these implements are preferred to the disc-ploughs in New England soils generally. Where practicable, still cultivate maize, potatoes, &c., but shallower as they progress towards maturity, so as not to destroy the valuable top lateral roots.

Rape may be sown this month for sheep in the winter—say about 4 lb. to the acre with drill, and 6 lb. broadcast. About half a hundredweight of superphosphate to the acre has been found very beneficial; it is sown here, mixed with the manure and through the manure feeders.

Barley may also be sown for green fodder, Cape and Skinless being the two best in this connection. Sow the latter thickly, as it is a poor stooler.

Ryes also do well here, and although not so sweet as barleys, stand feeding well in winter. The best are White, Emerald, and Thousandfold, in the order named.

Wheat and Oats.—For green winter feeding for stock, the Manitoba varieties in wheat, especially Power's Fife, stand the frost well, and, perhaps, Algerian stands stocking the best in oats, though for cutting, Tartar King or Danish Island are better, as they make stronger growths.

Richmond River.

H. R. ALEXANDER, Manager, Wollongbar Experiment Farm.

Paspalum and Silage.—Owing to the somewhat dry season, the growth of paspalum grass is not so rank as is usually the case at this time of year. For silage making purposes, paddocks will need to have been saved. Where this been done, no time should be lost in getting to work mowing and stacking the grass. When mown not later than February, paddocks, having two good growing months ahead, will be well grassed before winter. Paspalum grass makes a good, palatable silage; where grass is available will pay handsomely for conserving. Paspalum silage is improved, and will not be burnt, if, when

stacked, a temperature of 165 to 170 degrees is allowed before applying pressure. Any surplus crops of maize, sorghum, &c., should be stacked for silage. The second growth from sorghum or planter's friend, cut early in February, will, with favourable weather conditions, be almost equal to first cutting.

Maize and Sorghum.—Further sectional sowings of early maize, sorghum, &c., can be made during the month. This will furnish stock feed well into July. The advantage of small fortnightly or three-weekly sowings of fodder is more apparent on the Richmond River red soil than is the case on arabl land further south. Here crops grow and ripen rapidly; and when ripe, if not cut and conserved, soon die off, and, rotting, become valueless as fodder.

Potatoes and Vegetables.—Prepare land for winter crops of potatoes and vegetables. This land should be thoroughly ploughed, subsoiled, and liberally dressed with cowyard manure; manure to be ploughed under when planting commences. At this season of the year, good seed potatoes are almost unobtainable. Seed should be selected when digging summer crop, only good shaped tubers of medium size, from heavy bearing stems, being retained. As time for planting draws near (early March), arrange seed potatoes in shallow layers, and cover with straw, which should be kept damp, encouraging tubers to sprout. Special attention should be given to this, and only seed showing life should be planted.

Beauty of Hebron variety of potato is to be recommended for country similar to Wollongbar.

The Gardener at Wollongbar advises sowing seeds of cabbage and cauliflower in beds. Varieties—Succession and Flat Dutch cabbage, and of cauliflower, Autumn Giant.

Further sowings of French beans can be made. Canadian Wonder and Kentucky Wonder are both good sorts. Towards end of month small sowings of Yorkshire Hero peas is recommended.

GRAFTON.

A. H. HAYWOOD, Manager, Grafton Experiment Farm.

Stack Silage.—Sowings of maize or sorghum may be continued right through this month for winter feed. On the average dairy farm, 10 acres should be set apart for one of these crops for silage.

The method of silage stack building has been so often expounded that any doubt as to the success of the stack system should no longer exist. Farmers of this district who are not conversant with the system may see the process in operation at this farm during April, also the silo being filled.

Many have failed to make satisfactory silage by the stack system. These failures invariably have been due to two factors—

(1.) Stack two small and wanting in height.

(2.) Cutting the fodder at wrong stage of maturity—too dry or too green.

Hungarian Millet.—Where it is intended to sow lucerne in April or May, Hungarian millet may now be sown as a preparatory cleaning crop, and will provide a large bulk of green stuff for stock. Sow 20 lb. per acre broadcast.

Thousand-headed Kale.—Grows well here, and is a good winter feed. The seed is best drilled in 4 feet apart and thinned out, or the seed may be planted in seed beds and transplanted during moist conditions.

Dwarf Essex Rape.—Sow to catch the autumn rains, preferably broadcast, 8 to 9 lb. per acre.

Potatoes.—The late crop is best planted middle of this month. Potatoes follow a leguminous crop well. Avoid grubby and scabby seed, and where scab is suspected, treat uncut seed by dipping for ten minutes in solution of formalin (3 oz. to 15 gallons water). The varieties which have been found suited here are Early Rose, Manhattan, Satisfaction, Brownell, Early Vermont. The white-skinned varieties generally have failed to give satisfactory results.

Pumpkins and Melons.—To combat the pumpkin beetle, arsenate of lead, two teaspoonfuls to 1 gallon of water, and sprayed on while the sun is hot, checks; but slaked lime showered on through a sugar bag whilst the dew is on the plants is a sure remedy if repeated often. The old ironbark variety has been found almost immune to the ravages of this pest—the only variety out of many tried being so.

North-western Plains.

A. E. DARVALL, Manager, Moree Irrigation Farm.

Maize may still be planted in the early part of this month to be cut for feed or silage, but will be too late for grain; keep the cultivators and hoes going in that which was sown in January or earlier.

The land for *wheat*, *barley*, *oats*, *turnips*, *swedes*, etc., should now be ploughed at the earliest possible opportunity and be left unharrowed. This will allow any rain that falls to penetrate well into the subsoil and be stored there until the crops require it.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Sub-Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1909.

Society.	Secretary.	Date.
Alstonville A. Society	W. W. Monaghan	Feb. 3, 4
Coramba District P., A., and H. Society	H. E. Hindmarsh	,, 3, 4
Wollongong A., H., and I. Association	F. W. Philpotts	,, 4, 5, 6
Moruya A. and P. Society	John Jeffery	,, 10, 11
Shoalhaven A. and H. Association, Nowra	Henry Rauch	,, 10, 11
Guyra P., A., and H. Association	P. N. Stevenson	,, 16, 17
Luddenham A. and H. Society	W. Booth	,, 16, 17
Pambula A., H., and P. Society	J. B. Wilkins	,, 17, 18
Kangaroo Valley	E. G. Williams	,, 18, 19
Wyong A. Association	J. C. Martin	,, 19, 20
Tamworth A. Association	J. R. Wood	,, 23, 24, 25
Candelo A., H., and D. F. Association	A. D. Manns	,, 24, 25
Central Cumberland A. and H. Association	H. A. Best	,, 24, 25
Lithgow A., H., and P. Association	J. Ashley	,, 24, 25
Manning River A. and H. Association, Taree	S. Whitehead	,, 24, 25
Tumut A. and P. Association	E. H. Vyner	,, 24, 25
Ulladulla A. and H. Association	Jno. Boag	,, 24, 25
Gunning P., A., and I. Society	W. T. Plumb	,, 25, 26
Nambucca A. and H. Association, Macksville	M. Wallace	,, 25, 26
Robertson A. and H. Society	R. J. Ferguson	,, 25, 26
Tenterfield P., A., and M.	F. W. Hoskins	Mar. 2 to 6
Bangalow A. and I. Society	W. H. Reading	,, 2, 3, 4
Bega A., P., and H. Society	W. A. Züegel	,, 3, 4
Braidwood P., A., and H. Association	L. Chapman	,, 3, 4
Bellinger River A. Association	S. S. Hindmarsh	,, 3, 4, 5
Nepean District A., H., and I. Society, Penrith	Percy J. Smith	,, 4, 5
Taralga A., P., and H. Society	Chas. Ross.	,, 4, 5
Berrima District A., H., and I. Society, Moss Vale	I. Cullen	,, 4, 5, 6
Bombala Exhibition Society	W. G. Tweedie	,, 9, 10
Gloucester Show	Edward Rye	,, 9, 10, 11
The P. and A. A. of Central New England, Glen Innes	George A. Priest	,, 9, 10, 11
Molong P. and A. Association	Charles E. Archer	,, 10
Campbelltown Agricultural Association	Fred Sheather	,, 10, 11
Central Richmond River A. Society	D. Cameron	,, 10, 11
Tumbarumba and Upper Murray P. and A. Society	E. W. Figures	,, 10, 11
Bowraville A. Association	C. Moseley	,, 11, 12
Crookwell A., P., and H. Society	M. P. Levy	,, 11, 12
Oberon A., H., and P. Association	W. Mineham	,, 11, 12
Newcastle A., H., and I. Society	C. W. Donnelly	,, 11, 12, 13
Delegate P. and A. Society	C. M. Burton	,, 16, 17
Gulgong A. and P. Association	S. J. Cox	,, 16, 17
P. and A. Society, Delegate	L. H. Dobbie	,, 16, 17
Inverell P. and A. Association	J. McIlveen	,, 16, 17, 18
Cobargo A., P., and H. Society	T. Kennedy	,, 17, 18
Camden A., H., and I. Society	C. A. Thompson	,, 17, 18, 19

Society.	Secretary.	Date.
Armidale and New England P., A., and H., Association.	A. McArthur	Mar. 17, 18, 19, 20
Cobargo A., P., and H. Society	T. Kennelly	,, 18, 19
Port Macquarie and Hastings District A. and H. Soc.	W. A. Spence	,, 18, 19
Goulburn A., P., and H. Society	J. T. Roberts.	,, 18, 19, 20
Blayney A. and P. Association	E. J. Dann	,, 23, 24
Liverpool A., H., and I. Society	A. V. Woodward	,, 23, 24
Southern New England P. and A. Association	W. C. McCrossin	,, 23, 24
Hunter River A. and H. Association	C. J. H. King	,, 23, 24, 25
Quirindi P., A., and H. Association	W. P. B. Hungerford	,, 24, 25
Yass P. and A. Association	Will Thomson	,, 24, 25
Macleay A., H., and I. Association	E. Weeks	,, 24, 25, 26
Warialda P. and A. Association	W. B. Geddes	,, 24, 25, 26
Mudgee A. Society	H. Lamerton	,, 24, 25, 26
Clarence P. and A. Society, Grafton	T. T. Bawden	,, 24, 25, 26
Horticultural Society of N.S.W	H. H. Bradley	,, 25
Gundagai P. and A. Society	A. Elworthy	,, 30, 31
Lower Clarence A. Society	Geo. Davis	,, 30, 31
Murrumburrah P., A., and I. Association	J. A. Foley	,, 30, 31
Walcha P. and A. Association	J. N. Campbell	,, 30, 31
Bathurst A., H., and P. Association	G. W Thompson	,, 30, 31, Apl. 1, 2
Cooma P. and A. Association	C. J. Walmsley	Mar. 31, Apl. 1, 2
Upper Hunter P. and A. Assoc., Muswellbrook	J. M. Campbell	Mar. 31, Apl. 1, 2
Royal Agricultural Society, Sydney	H. M. Somer	Apl. 6 to 14
Mungindi P. and A. Association	C. W. Lowe	,, 21, 22
Orange A. and P. Association	W. Tanner	,, 21, 22, 23
Narrabri P., A., and H. Association	W. H. Ross	,, 27, 28, 29
Richmond River A., H., and P. Society	D. S. Rayner	,, 28, 29
Wellington A. and P. Association	A. E. Rotton	,, 28, 29
Upper Manning A. and H. Association, Wingham	D. Stewart, jun.	,, 29, 30
Moree P. and A. Society	D. E. Kirkby	May 4, 5, 6
Dubbo P., A., and H. Association	Fred Weston	,, 5, 6
Durham A. and H. Association, Dungog	C. E. Grant	,, 5, 6
Coonamble P. and A. Association	J. M. Rees	,, 12, 13
Hawkesbury District A. Association	C. S. Guest	,, 13, 14, 15
Central Australian P. and A. Association, Bourke	G. W. Tull	,, 19, 20
N.S.W. Sheepbreeders' Association	A. H. Prince	June 30, July 1, 2, 3
Pastoral and Agricultural Society of Deniliquin	L. Harrison	July 15, 16
National A. and I. Association of Queensland	C. A. Arvier	Aug. 7 to 21
Corowa P., A., and H. Association	J. D. Fraser	,, 17, 18
Forbes P., A., and H. Association	N. A. Read	,, 18, 19
Murrumbidgee P. and A. Association, Wagga Wagga	A. F. D. White	,, 24, 25, 26
Parkes P., A., and H. Association	G. W. Seaborn	,, 25, 26
Northern A. Association, Singleton	F. A. Bennett	,, 25, 26, 27
Grenfell P., A., and H. Association	Geo. Cousins	,, 31, Sept. 1
Junee P., A., and H. Association	T. C. Humphrys	Sept. 1, 2
Lockhart A. and P. Society	H. Parnaby	,, 7, 8
Young P. and A. Association	J. F. Dwyer	,, 7, 8, 9
Cudal A. and P. Society	P. Gavin	,, 8
Germanton P. and A. Society	James S. Stewart	,, 8, 9
Cootamundra A., P., H., and I. Association	W. E. Williams	,, 14, 15
Albury and Border P., A., and H. Society	W. I. Johnson	,, 14, 15, 16
Henty P. and A. Society	P. H. Paech	,, 28, 29

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Agricultural Gazette of New South Wales.

Creating a New Province.

THE STATE'S GREAT IRRIGATION SCHEME.

E. HARRIS (late Secretary, Water Conservation Board, N.S.W.).

IN 1910 we are promised by the Minister for Public Works, that the land which, under this scheme, is to be irrigated by the waters to be conserved in the Barren Jack Reservoir, will be available for settlement. A large

Fig. 1.—Berembed Weir.

area of land, extending from Narrandera to Hay and Gunbar, which at present cannot be more profitably utilised than as a sheep run, will become capable of the most intense culture, from which will be obtained products more abundant and varied than are possible from ordinary culture. The blocks will vary in size from 10 to 100 acres, and an area of land which has hitherto been capable of rendering sustenance to ten sheep, will, under irrigation, support a family in comfort.

One of the greatest benefits of an irrigation scheme is the resultant closer settlement, with its improved social and educational advantages. "The bane of rural life is loneliness," but it will have no place amongst the 50,000 to 100,000 people who will make their homes on the model subdivisions which, no doubt, will be a feature of the scheme.

The preparatory work at the dam has been completed, the distributing canals are in course of construction, and a contract for the dam itself, which will be classed amongst the largest of the world, has been let. At this stage, the following particulars of the dam, the canals, and the land to be irrigated, will be found of interest to agriculturists.

Fig. 2.—Another view of Berembed Weir.

The Barren Jack Dam.

The Barren Jack dam is situate across the Murrumbidgee River, some 2 miles below its confluence with the Goodradigbee River. It is some 30 miles from the town of Yass, the neighbourhood of which has been selected for the establishment of the Federal Capital. The rainfall over 5,000 square miles of country (an area some 60 miles broad, stretching from Yass in the north to below Cooma in the south), will feed the reservoir by means of the Queanbeyan, Molongla, Yass, and Goodradigbee Rivers, and numerous creeks. The depth of water at the face of the dam will be about 200 feet, and when full, 209,500 millions of gallons will be impounded, or sufficient to cover 766,324 acres 1 foot deep.

From Dam to Canal.

The water will pass from the reservoir through two openings controlled by sluices, and will flow down the channel of the Murrumbidgee River for a distance of about 220 miles, passing the towns of Gundagai and Wagga, to a place called Berembed, about 20 miles above the town of Narrandera, where a movable weir with a lock for navigation purposes will be built, and which will admit of water being diverted into canals to irrigate the lands on both sides of the river. The scheme at present under construction will, however, only deal with the northern side of the Murrumbidgee, embracing an area of 1,500,000 acres from Narrandera to Hay and Gunbar.

Fig. 3.—Temporary Regulator, Bundidgerry Creek.

After passing through the weir at Berembed, the natural channel of the Bundidgerry Creek is utilised more or less until Narrandera is reached. The water is then conveyed by means of a canal, and our illustration will give some idea of its size.

The line of canal passes through Narrandera and skirts the hills abutting on the plains in a north-westerly direction to its terminal point, 132 miles from the off-take at Berembed and about 10 miles north-east of Gunbar. One main branch canal, 90 miles in length, running parallel with the Hay railway, is ultimately proposed to be extended to Hay, distributing channels being constructed to follow the fall of the country to distribute the water over the land both north of the canal and between the canal and the Murrumbidgee River.

The Illustrations.

We are indebted to the Under Secretary for Public Works for the accompanying illustrations, from photographs taken by Mr. Degotardi, the Photographer of the Public Works Department. They relate chiefly to the progress made with the main canal for conveying water from the Murrumbidgee River, above Narrandera, to the area to be irrigated.

Fig. 1 shows the work in hand at Berembed weir. The water has been diverted from the bed of the river where the men are at work on the solid rock. The great concrete wall on the left shows the abutment of one end of the weir, while the vertical steel erection in the centre of the background, is

Fig. 4.—Regulator at Narrandera.

portion of the regulator gate through which the water will be admitted into the canal. The main cut of the canal will be in the back under where two men are standing against the sky line. Fig. 2 is another view of the weir.

Fig. 3 shows a temporary regulator which was put in to admit water through Oak Creek to the portion of canal already constructed, pending the completion of the Berembed weir. The water flows through this regulator only when the river reaches a height exceeding 7 feet on the Narrandera gauge, and it has not been constructed of the same width and capacity as the permanent regulators, one of which is illustrated further on.

Fig. 4 shows the permanent regulator at the Narrandera Common gate in the vicinity of Narrandera. It is a quadrant regulator, the gates of which lift vertically, revolving at the same time round an axis. Great care is

necessary in designing these works in order that the regulator should not produce any swirl or disturbance in the water which would be likely to injure the adjoining banks of the canal, and it will be seen that the canal is widened at this place, and curved wing walls are introduced to lead the water gently into the canal as it passes through the regulator.

Fig. 5 shows a section of the main channel in the vicinity of Narrandera. The canal was designed to carry 1,200 cubic of water per second, and at the place shown in the photograph an embankment is constructed along that side of it which is nearer the Murrumbidgee River, to guard against the possibility of flood-waters entering the canal. From that point the canal travels

Fig. 5.—Making the Main Northern Murrumbidgee Canal.

to the north-west and leaves the Murrumbidgee River, running straight out through North Yanco and on to the Mirrool Creek. Fig. 6 is another view of the work under construction, showing the method of excavation by means of wheeled scoops, and Fig. 7 shows the completed canal near Narrandera.

The Land to be Irrigated.

As previously stated, the present scheme will deal with the lands on the north side of the Murrumbidgee River only. These have all been carefully classified, and it is estimated that 196,000 acres are first-class, 162,000 second-class, and the remainder third-class. The first-class land is of a rich, red, loamy character, of considerable depth, with a subsoil of rubbly limestone, and has a good natural drainage. It is timbered with pine, belar,

yarran, and small clumps of mallee. The second-class land has a shallower soil of a heavier nature, with a subsoil of fairly stiff clay. The surface drainage is good and the natural timbers are scattered pines on the best of it, and bare over the remainder. Of these lands only a proportion is still retained by the Crown, and legislation will be necessary to authorise the Government to acquire for closer settlement the land to be irrigated.

These lands have been examined by the experts of the Department of Agriculture, who considered that considerable areas in the vicinity of the surveyed line of channel are remarkably well suited for irrigation purposes, and so much so that not only could mixed farming be carried out with profitable results, but that fruit-growing and drying could also be undertaken with a certainty of success, provided that those who may take it in hand have some acquaintance with the business.

Fig. 6.—Making the Main Northern Murrumbidgee Canal.

The Soil.—The soil in the district varies in quality, some of it being of a heavy clayey character, whilst other parts are of a light loamy or sandy-loam nature.

The soils best suited for the growth of crops under irrigation are those of a light loamy and porous character, notwithstanding the fact they are sure to absorb more water than the heavier soils. Having the advantage of good natural drainage, those light soils will not become waterlogged, as the heavier soils are likely to do.

The light, reddish, sandy loam to which the irrigation farms should be confined, as far as possible, is about the easiest of all to work under irrigation; hence those who may settle on this land will be able to secure the maximum results at a minimum expenditure of labour.

The country lies close to a range of very low hills, the land which is proposed to be placed under water being practically level, most of it having only a foot or two fall to the mile, and but little of it will need levelling preparatory to planting.

Fruit and Crops that can be grown.—The fruits which could be grown profitably under irrigation, provided the trees and vines are given proper attention, are lexias, sultanas, currants, figs, peaches, apricots, prunes, citrus fruits, almonds, and wine grapes. Of general crops, lucerne, sorghums, millets of varieties, early varieties of maize, tobacco, and vegetables of all kinds. Tobacco should give satisfactory yields ; and as cotton should thrive well in

Fig. 7.—The Main Northern Murrumbidgee Canal.

this district, it is possible that good returns could be obtained, yielding a satisfactory profit.

The growing of lucerne for the feeding of dairy and other stock—sheep and pigs—should prove highly remunerative, even on a small area, the estimate being six cuttings per annum. Pig-keeping should prove highly profitable, either by itself on the lucerne or, better still, as an adjunct to dairying.

The growing of sultana raisins, lexias, and currants should prove highly remunerative for the supply of the Australian market, and for export. For home consumption, the grower is protected to the extent of 3d. per lb. on dried fruits. One man and family could easily manage all the work in connection with the picking, curing, and production from 20 acres of land.

With respect to fruit-growing for drying purposes, this could be undertaken in addition to any other crop or industry, and under proper care should yield at least £10 per acre.

Should a settler be here without family he would need assistance for the picking, but during that portion of the year when sheep-shearing is not in full swing, there should be no difficulty in obtaining hands for fruit-picking, handling lucerne and other crops, as shearers usually make their way to such settlements, in order to pick up whatever work they can during off seasons, and, fortunately, it is the season during which there is most work to be done in such a settlement as this would be.

Peaches and apricots should yield well in this district under irrigation, and when the trees are in full bearing—three or four years old—the net profits per acre per annum for the dried fruits should be about £14.

Fig. 8.—Disc plough, Yanco Irrigation Farm.

Citrus fruits—four to six years old—should give a net profit per acre per annum of £8 or more.

Figs may be expected to thrive exceptionally well here under irrigation, and should give per acre per annum a net profit of £28.

In some of the deepest and best pine country the culture of the Smyrna variety of fig should prove to be a very profitable industry, as this species should succeed well in the district.

Tobacco of a high quality could probably be produced here if the necessary skill for its cultivation and manipulation be forthcoming, and tobacco-growing should prove profitable.

Of root crops, Jerusalem artichokes, turnips, swedes, potatoes, and sweet potatoes, should succeed very well, and vegetables—such as cabbage, cauliflower, broccoli, asparagus, melons, onions, leeks, lettuce, rhubarb, carrots,

tomatoes, egg-plants, capsicums, pumpkin, &c., could be grown to perfection, and it is probable that many of these could be profitably produced for the supplies of the large centres.

The soil and climate admit of the profitable varying of mixed farming, dairying, and stock-rearing, provided the supply of water is assured and judiciously applied.

Cost of clearing and grading the land.—The cost of clearing the country of trees, stumps, &c., will not be heavy. Some parts have very little timber and stumps left, and can be cleared for a few shillings per acre.

Most of the pine land can be cleared for from £1 5s. to £2 per acre, while the large mallee and pine and box mixed might cost £2 10s. per acre. On

Fig. 9.—Flooding lucerne crop, Yanco Irrigation Farm.

the greater part of this country there is enough pine for fencing purposes, so that most of this work could be done at a very small cost per mile.

Grading the land preparatory to planting or sowing to lucerne and other crops will not cost anything on the greater part of the area suitable for irrigation, as it is very level, having only a slight fall in one direction, and it lends itself admirably to growing crops under irrigation.

The Yanco Irrigation Farm.

In the *Agricultural Gazette* for November, 1908, there was published a description of this farm, which has been established for the purpose of demonstrating what will grow on the land to be watered by the Northern Murrumbidgee Irrigation Scheme. Figs. 8 and 9 show respectively a disc plough, employed at the farm, and the flooding of a lucerne crop.

Artificial Incubation.

[Continued from page 134.]

G. BRADSHAW.

Incubators in Australia.

ALTHOUGH there may have been occasional privately-built incubators in this State prior to 1880, it was not until that year that they became a marketable article, or about two years after the invention of Christy's hydro-incubator. The first public announcement in connection with this new article of merchandise was by Messrs. Lassetter & Co., Sydney, and ran as follows:—"We have imported a number of Christy's hydro-incubators, which may be seen at our warehouse." The agency possibly changed hands, for a few years later we find W. S. Friend, of York-street, advertising the arrival of Christy's new thermostatic incubator, from 40 to 100-egg size; and the same year Holdsworth & Co. announced the arrival of a number of the latest invention, Hearson's patent incubator, the latter up to that time having been the greatest achievement in artificial hatching.

Up to 1884 there had been no Australian-made incubators, but in that year the late H. H. Hoddinott, of Coburg, put a locally-made one before the Victorian public. They were named the "A.B.C." and the "Excelsior." The former was made from 25 to 100-egg size, the "Excelsior" being up to 500-egg capacity, this being the largest hatching machine up to that time seen in Australia.

These incubators were introduced to New South Wales in 1886, and the same year the manufacturer, anxious to get its efficacy tested, forwarded one to the proprietor of the farm where I was engaged. The machine was in the form of a cabinet, there being six or eight egg drawers, one above the other. The water-tank extended over the eggs, down each side and the back to the floor of the incubator, the water thus being over and around the eggs.

I operated the machine, and distinctly remember that the result of the first hatch was equal to that obtained from a Hearson. The second trial of this chest of drawers was to determine its purchase or return, neither of which eventuated, for when the hatch was about half through the apparatus took fire, it and the eggs being reduced to ashes. Then (as at the present time, if anything goes wrong), the machine was blamed, although it is just possible that the lamp had not been given the necessary careful attention.

At that time I had great hopes of the successful development of the system of a series of drawers, but the inventor shortly afterwards died, and while his brother continued to manufacture the "A.B.C." and "Excelsior," the 500-egg capacity one was allowed to lapse. The plant and patents were shortly afterwards transferred to Mr. Johnston, of Victoria, who, up to a few

years ago, did a successful business with them in that State. They were self-regulating, and used but about one-fourth the oil required by Hearson's.

The next local machine was made by Mr. Hadkins, of Bathurst-street, Sydney, and was an adaptation of Hearson's. It was well made, did good work, but for some reason its manufacture has ceased.

Following or concurrent with the Hadkins, Mr. Stewart, of St. Peters, about 1893, believed there was an opening in this country for a moderate priced practical hatcher. That year he placed the "Nonpareil" on the market, in two grades, A and B. They are hot water, self-regulating machines, and from that period to the present time, have given results equal to any, no matter where manufactured.

The fact of the "Nonpareil" having successfully competed during the past sixteen years with the American importations, is sufficient testimony to its hatching abilities.

Shortly after the introduction of the "Nonpareil," Messrs. Ellis and Dobeson, large poultry farmers of Botany, brought out for public approval the "Egyptian," a hot-water machine, and later the "Zenith," a hot-air one. These are still on the market, and, like all those mentioned, given good eggs, a suitable place for the machine, and attention to the maker's instructions, big hatches result.

Some ten years ago Messrs. A. Hordern and Sons considering that the majority of the incubators then on the market were too high-priced, concluded to cater for the growing trade at a more reasonable rate than then obtained. The firm soon had one on the market named the "Mascot," which, like all those mentioned, continues to give good or bad results according to the conditions. There is still a demand for the "Mascot," which in the light of the manufacturers being agents for American makes, speaks well for it.

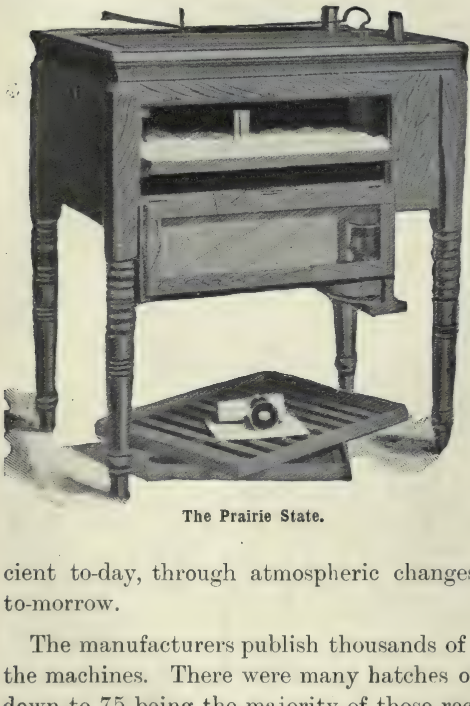
This exhausts the Sydney-made machines, which have stood the test of time. There were others of local manufacture, but they are not now much heard of. The "Sideway" for a time was well known, also the "Preddy," a few others with a brief existence completing the successful and unsuccessful attempts in this State of solving the problem of hatching chickens by machinery.

Construction of the Machines.

Of the 100 or more kinds of incubators at present in practical operation, perhaps a dozen have the call in this State, and while the control of the heat is the chief claim of all, with the secondary consideration of moisture and ventilation, the construction to these ends are widely different.

The "Prairie State," hot air, has been in existence for over twenty years, and is covered by three patents. In the application of heat the plan of the sitting hen has been followed; that is, the heat radiates from above, and is claimed to be equal in all parts of the egg chamber. The lamp is at the end of the machine, and the chimney extends up into a flue passing through it. From this the heat is directed into a radiator, which covers the entire top of the egg chamber. Pipes at the end allow the heat to escape from the

radiator, thus keeping up a circulation, and maintaining a uniform temperature. The air from the lamp never comes in contact with the eggs. The heat is regulated by a new shaped thermostatic compound bar of sensitive metal. This is connected by a rod with a valve covering the lamp flue. As soon as the heat becomes dangerously high, the bar acts and releases the valve, thus directing the heat outside the machine. Moisture pans are provided for the incubator, but the manufacturers say that, unless in very dry climates, moisture is not required.



The Prairie State.

Ventilation is provided by a very common-sense method. The air enters the incubator from below, through a tube surrounding the lamp flue. It is in this way gently heated, passes upward into the egg chamber, where it is released; it then passes down among the eggs, makes a circuit of the drawer, and escapes through a row of small ventilating holes in the bottom and end of the machine. The ventilating flue is provided with a small sliding cover, so that the ventilation can be increased or decreased as the operator wills, for the ventilation which may be sufficient to-day, through atmospheric changes, may be too much or too little to-morrow.

The manufacturers publish thousands of testimonials as to the efficacy of the machines. There were many hatches of 100 per cent., from that number down to 75 being the majority of those recorded.

No one expects 100 per cent., although such results occur, yet if a machine gives 95 to-day and but 80 in the next hatch, then clearly the machine is not responsible for the poorer results.

The "Petaluma" incubators were introduced to public notice in 1879. The manufacturers then believed that the hot-air system was the correct one.

The "Petaluma" is self-regulating. The regulator just above the eggs expands and contracts with so slight a change of temperature as scarcely to be indicated by the thermometer, and operating on the lever which is connected to the burner of the lamp, turns the blaze up or down, keeping the temperature regular. The regulating screw is located in the lever under the machine, and therefore reached without having to open the door. The slightest turn of the screw is all that is necessary to adjust, and it is seldom that it needs to be touched.

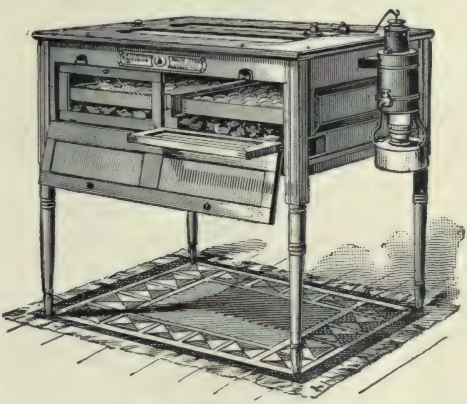
Fresh air is admitted at the bottom end of the heater, and while passing up through, is properly warmed, and is discharged into the egg chamber, passing downward, over and around the eggs, and finally making its escape below the eggs into proper openings or channels in the walls, and thence upward and out at the top of the machine, expelling all carbonic acid gas thrown off by the eggs during incubation.

The subject of ventilation has of late had a good deal of discussion. The manufacturers of the "Petaluma" have had a life experience with every phase of hatching, and on the subject say :—

Ventilation and Moisture are essential and inseparable features of the perfect incubator. Moisture is used in an incubator to prevent too great an evaporation of the watery elements from the egg. If little or no air is passed into the egg chamber, little or no evaporation from the egg will take place, but what can be expected of chicks hatched in a dead atmosphere, or one not frequently renewed by the admission of fresh air, from which proceeds the necessary oxygen to vitalise or vivify the growing chick? No one needs to be told what is the result in a pond where the water ceases to flow and renew the elements which sustain life therein, or the result of an effort to propagate animal life in a hothouse or overheated and poorly-ventilated room. Everybody understands this from a common-sense standpoint, if not from the scientific.

The thousands of testimonials of the above machine include many from Australia, and on several occasions every egg was hatched.

The "Wooden Hen" and the "Excelsior" are hot-water machines, the teachings of nature being followed in their construction. The tank is so built that the hot water is forced to flow over every portion of the egg chamber. It is kept in constant circulation, thus ensuring a uniform temperature. The heating is accomplished by means of a kerosene lamp which has no connection with the regulating mechanism. The regulation of the heat is obtained by means of a sensitive thermostat. Two flues are provided for the lamp through the heater of the tank, one of these flues being inside the other. The instant the temperature of the egg chamber rises to the set point, a valve is automatically raised, and all the heat from the lamp escapes through the centre flue, without heating the water.



Excelsior Incubator, in three sizes.

In connection with ventilation and moisture the manufacturer says :—

Very necessary to successful operation is a supply of pure air, and the removal of the foul gas constantly thrown off the eggs while under heat, and which, if left in the machine, will surely kill the embryo chicks. All the air that enters the egg chamber is regulated by the ventilator in the back. The ventilation is constant, being entirely independent of the regulation of the heat, so that there can never be an accumulation of foul air in the egg chamber. A moisture diffuser is placed in the egg chamber, and supplies the necessary moisture to the eggs.

The American testimonials to the above machines show from 75 to 100 per cent. of fertile eggs hatched.

At a large poultry farm in a Brisbane suburb, 100 per cent. was obtained from hen eggs, and from eighty duck eggs seventy-nine ducklings were hatched. Another trial gave eighty-two ducklings from eighty-four Muscovy duck eggs.

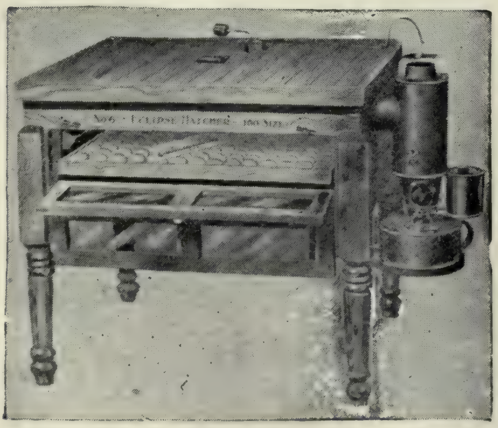
The "Ideal" incubator is made in two styles—hot air and hot water—and in three sizes.

In the hot-water machine, the tank is tubular in shape, is made of rolled copper, and extends around the four walls of the incubator. The water circulates freely and constantly, thus affording a perfectly even distribution of heat all through the egg chamber. In relation to ventilation and moisture, the experienced inventor says :—

Everybody knows that during incubation eggs throw out impure gases. These gases must be forced from the egg chamber at once by a constant supply of pure air coming in, or the hatch will be spoiled. At the same time, it is dangerous to allow too much ventilation, or some draughts may get to the eggs. We have solved the ventilation problem in our hot-water incubator in the only sensible, practical way. A supply of fresh but warm air is constantly admitted to the egg chamber, and the noxious gases being lighter than pure air, rise to the top and escape through the vent. This safe and thorough ventilation system has been a great factor in creating the wide popularity of the "Ideal."

The question of moisture is often misunderstood, and causes the inexperienced a good deal of trouble. If the heating and ventilating systems of an incubator are right, there is not much need of any extra moisture, except, possibly, in some very dry climates, such as New Mexico, Arizona, Colorado, and a few other western states. But with the "Ideal's" hot-water system and perfect ventilation, customers seldom resort to applied moisture.

The heating by hot air of the "Ideal" is a very simple system. The heat goes up through an inner tube and turns into a long tube which extends the length of the incubator, and from this is conducted to each corner of the machine. There is a galvanised iron top to the incubator chamber, which is termed the radiator. This is heated by a steady stream of hot air, and the radiation of it is downwards into the egg chamber. The "Ideal" has a wonderful sale in the United States, while the very high hatching results obtained in this State testifies to its suitability for Australian conditions.



The Eclipse, 100 egg hot water Incubator.

The "Successful" and "Eclipse" are two incubators well known here. They are made by the Des Moines Incubator Company, of Iowa, and are to be had on both hot-air and hot-water systems.

In the hot-water one the heating-flue extends from the reservoir, which is stationed above the lamps, straight through the front portion of the tank, and projects out of the machine at the opposite end, which affords easy access to the interior of the flue for the purpose of removing any

accumulated soot. The heating reservoir is very simple. When the water has become heated to 100 degrees, a circulation begins, and when the water is forced out of the pressure-drum, it travels through the entire tubular coil and produces an even temperature in the egg chamber.

In the hot-air system the lamp is situated under the machine at one end. The heat is discharged into a tank, through a double flue which surrounds the upper part of the lamp, and connects with the tank, which is made of galvanised iron, of rectangular form.

Inside the tank there is an arrangement of flues, which carry the hot air to every corner of the tank, takes it along the sides, and discharges it through two holes at the top of incubator. The regulator is of the wafer or disc style, and filled with a liquid which expands or contracts when submitted to heat or cold.

In connection with ventilation and moisture, the manufacturers say:—

The value of pure air in maintaining animal life is an accepted and incontrovertible fact. It follows, therefore, that it is of equal importance to the embryo chick during the period of incubation. The scientist, who has given the matter of fresh air its due amount of consideration, insists that the proportion of fresh air required is much greater than is generally accorded. An essential, then, of a good incubator, is a system of ventilation which will supply a sufficient volume of pure air, and which will least affect the temperature of the eggs. We believe that we have solved this problem, and that our incubators are provided with such a system for supplying and distributing air as fills even the scientific requirements. It not only furnishes fresh air in requisite volume, but at a temperature of proper degree. To fit our machines with such a perfected system has taken no end of careful and expensive experiment, and it is with no small degree of satisfaction that we refer to this feature.

The subject of moisture is one on which many unnecessary words have been said. As a general proposition that atmospheric moisture supplied in a properly ventilated machine cannot be improved upon. The laws of nature, here as elsewhere, are all sufficient. For the accommodation of those who wish to make use of artificial moisture, we supply all our machines with moisture pans, but we do not recommend their use, except in certain cases.

The testimonials show hatches from 70 to 100 per cent. of the fertile eggs.

The "Cyphers" is one of the best known American incubators in the market. The Company has agencies in every European country, and the machine has a great sale in England, is popular throughout the Commonwealth, and has many patrons in this State. The Company has an immense experimenting department, where as many as forty different kinds of machines have been in operation with the object of solving the problems which occasionally crop up in artificial methods of hatching.

The "Cyphers" are hot-air machines. The lamp is clear of the machine, and instead of conveying the heat through a metal chimney into the incubator, there is what is called a heater between the lamp and machine, which is instrumental in carrying into the heating chamber a large volume of moderately warmed air, rather than a small quantity that is immensely heated. The "Cyphers" has a special system of distributing the heat amongst the eggs, named the diffusive principle, which is claimed to insure the most perfect results in the greatest divergence of temperature, and to solve the problem of ventilation and moisture. The principle consists of what are called diaphragms, *i.e.*, frames covered with cloth or other material, one each being

placed over and under the egg drawer, the object and results of which are as follows :—

When the "Standard Cyphers" is in operation, the fresh pure air that enters the heater is first warmed, then distributed evenly over the whole area of the top surface of the upper diaphragm before it enters the hatching chamber. After being diffused through the minute pores of closely-woven fabric, the air is gradually forced down around the eggs, and through the incubating chamber in a slow but positive manner, entirely without air currents or the slightest direct draft on the eggs. Thence it is diffused through another porous diaphragm placed above a shallow chamber in the bottom of the incubator and is drawn out into the exhaust pipe of the heater, carrying with it such gases as are thrown off by the eggs, where the major part of it is discharged into the open air.

This method of applying heat and insuring automatic ventilation gives a large volume of pure fresh air, and accomplishes both results without the disastrous effects of profuse direct ventilation, also without the slightest danger of chilling a large percentage of the eggs, as is the case when streams of cold air are admitted directly to the hatching chamber. This construction provides an entirely automatic system of ventilation that is sufficient in itself to produce excellent hatches, especially where the machine is operated in an apartment the temperature of which ranges below 60 to 65 degrees, even though all ventilators are kept closed, either as a result of carelessness or lack of experience. In other words the "Standard Cyphers" is practically "neglect-proof," and will bring off good hatches, so far as ventilation is concerned, provided the lamp is kept going and the regulator adjusted. By the improved method of construction we have secured for the experienced operator the maximum of elasticity as regards ventilation, with which to meet the widely varying conditions that exist during different seasons of the year. We also have been able to overcome, in a large measure, the extreme climatic variations found in different latitudes and at widely differing altitudes, and whether it is operated in a cool cellar, in a warm living room, or in any other place where incubators are run, that is cold at night and quite warm during the day, the ventilation can be so controlled that the results will be satisfactory.

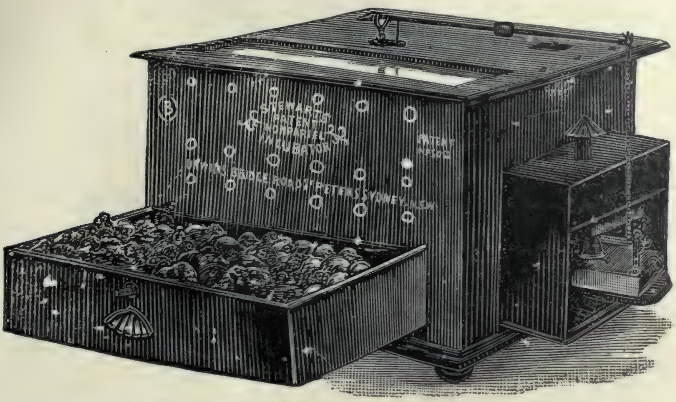
The latest type of the "Cyphers" has an additional improvement in what is named a drop or hinged bottom below the egg drawer, which can be let down any distance, and is specially adapted for warm climates when the incubator room reaches 70 degrees or over. The object is to ensure more ventilation than is ordinarily required in temperate climates. The "Cyphers" publish a special colonial catalogue, and included in the testimonials is one from the Hawkesbury College, when an 86 per cent. result was obtained in 1901. Since then there have been many improvements in the machine.

The "Reliable" is a low priced American incubator, and is on the hot-air system. The manufacturers claim that its superior construction enables it to stand in a class by itself. The regulation of the heat, moisture, and ventilation are all simply but effectually provided for. The results are so invariably good that the manufacturers guarantee to return the price of the machine to any one who is dissatisfied with its performance.

The above are all American made, with established agents here. English makers do not cater for the Sydney trade, the few machines from that country at present in the State being confined to the well-known Hearson.

Locally-made Incubators.

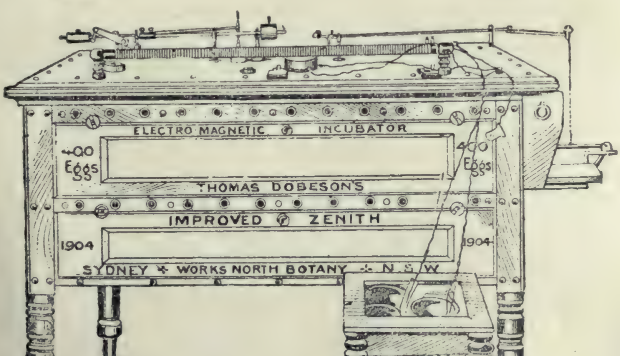
The Sydney-made incubators at present on the market, although largely an adaptation of some of the best features of the English and American, have each some distinguishing features apart from those mentioned, and whether for simplicity, price, or results, are equal to any in the market. The "Nonpariel," manufactured by Mr. Stewart, of St. Peters, is a hot-water machine, made of Californian redwood, in two grades, the fittings of brass or iron, and the tanks copper or iron.



Improved Nonpariel.

The trip of the lamp is so arranged that when the temperature gets too high, the regulator does not, as in many incubators, deviate the heat outside the machine, but cuts off the flame, and when the temperature falls the flame is liberated. Moisture and ventilation are supplied very simply. There are four holes at the bottom of the machine, through which the air is drawn upwards, through the moisture tray, then through the egg drawer, and eventually into the upper portion of the machine, when it escapes. The eggs are thus at all times surrounded with an ample supply of pure air. The machines are used at the Hawkesbury College, Mr. Thompson's report showing 81, 86, 94, and 81 per cent., which should be conclusive as to all the claims made for it by the manufacturer.

At the Gatton College, 79 per cent. was obtained, and in a book full of testimonials the records occasionally go up to 99, and, in some instances, to 100 per cent. The "Nonpariel" is noted for the very small quantity of oil it consumes.

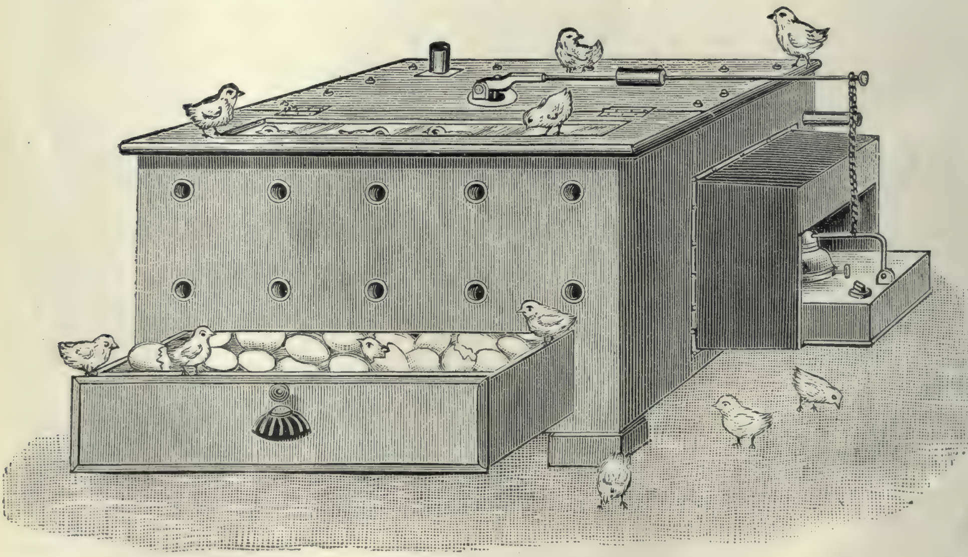


Improved Zenith.

The "Egyptian" and "Zenith," manufactured by Mr. Dobeson, of Botany, have been before the public for about a dozen years. They are of hot water and hot air respectively. Mr. Dobeson says for the "Egyptian" that it is not encumbered with complicated attachments. Its regulator cannot get out of order. It only wants common-sense to manage it. Both machines are in use in every State of the Commonwealth and in New Zealand. Hundreds of testimonials have been received by the maker, the latest being dated 14th November, 1908, which shows 100 Muscovy ducklings from 100 eggs, and as these take five weeks to hatch as against three for chickens, the results are the more extraordinary. The same breeder's prior hatch was forty-three chicks from fifty eggs.

Mr. Dobeson says:—

> The records are the result of several years' hard study and tests, or, as the Americans call them, experiments. I have been working quietly to have the very best brand of hatching machines, and have given much time to find out just the right quantity of ventilation, and also the right velocity or speed it should travel, together with the right temperature for this ventilation apart from the tank heat; for if dry winds come about just before hatching time, such has to be provided against.



The Mascot.

The "Mascot," manufactured by Messrs. Anthony Hordern and Sons, is a hot-water machine, with capsule regulator, much on the principle of the well-known Hearson, moisture and ventilation being simply provided for. The machine has many friends in New South Wales, and the builders hold a large number of testimonials as to high records and general efficiency.

This exhausts the machines at present being built in this State. The local manufacturers fail very much in one thing in comparison with their American competitors. They tell briefly but plainly the good points of the article they make, and support their claim by hundreds of testimonials from well-known

breeders in every State in the Commonwealth. The Americans, on the other hand, are not content with a page or two of descriptive matter about their goods. They publish bulky, well illustrated catalogues, some of them running up to over 200 pages. The machines are not only illustrated, but described in detail to the last coat of varnish, and photographs of incubator rooms, poultry farms, and even of their customers, are given. Indeed, this has gone to such an extent that there is now keen competition in America amongst a few of the leading makers, as to who will have the bulkiest and costliest annual catalogue. Further than this, many of the manufacturing companies own large poultry farms. These they depict, together with a varied collection of poultry appliances other than hatchers.

It has, of course, to be remembered that these big concerns are catering for a population of about 80,000,000 people, about fifty times as many as there is in this State. Consequently, it can be readily understood that the sales in that country reach hundreds of thousands annually, the highly-coloured catalogues being attractive means of securing sales. The local and American manufacturers usually make fifty eggs the minimum capacity of the incubators, but 100 eggs is the most favoured, while those of 200 or 300 capacity are common. Larger sizes than 300 are rarely used in Australia, but are of common occurrence on the big poultry plants in America.

(*To be continued.*)

Some Common Diseases of Dairy Cattle.

[Continued from page 97.]

MAX HENRY, M.R.C.V.S., Government Veterinary Surgeon.

NON-INFECTIOUS DISEASES.

Parturient Toxæmia.—Milk Fever.—Dropping after Calving.

This is a disease of cows most liable to occur at the time of the third or subsequent calving, but rarely attacking old cows. The cows most likely to be attacked are heavy, rich milkers in good condition ; hence it is far more common amongst dairy herds than amongst beef cattle. The cause of the disease cannot be stated with any certainty, but it has been ascribed by different authorities to the absorption of poisonous substances from the udder or womb, or to the presence of too much or too little blood in the brain. It is not common after a difficult calving, and is just as frequent when the calf is allowed to suck as when it is taken away directly after birth. The onset of the disease usually occurs about twelve hours after calving, but may be delayed for two or three days, and the attack is then likely to be far less severe. The cow is noticed to walk in a peculiar manner, showing signs of pain ; the coat is harsh and the eye staring. The cow lies down, but may get up and lie down again, at last remaining down with the head turned round on the flank and almost unconscious ; the secretion of milk is diminished or almost stopped, and the bowels are constipated ; the breathing may be a little fast, and sometimes noisy. As digestion is stopped the cow soon becomes tympanitic. If neglected, she may die in twelve hours, or linger on for two or three days, but if no complications set in, she will usually recover in two or three days if she lives for forty-eight hours from the beginning of the attack.

Preventive treatment should be adopted in the case of cows which have had one attack, or whose condition is such as to render them liable to be attacked. They should not be allowed to become too fat during the last months of pregnancy, while the bowels should be kept open, if necessary, by giving ½ lb. of Epsom salts and 1 ounce of ginger a few days before calving.

Once an animal is attacked, treatment should be immediately commenced, as any delay may be fatal. The most efficient treatment consists in the injection into the udder of a solution of 2 drachms of potassium iodide in a quart of warm water, one-fourth part into each quarter ; or in inflating the udder, after stripping, with oxygen or air, which, for want of the proper instrument, may be done with a teat syphon and bicycle pump, and the udder massaged. The teat syphon should be boiled before using. The cleansing should be removed if it has not come away, the urine drawn off if possible, and the

bowels emptied by giving an enema of soapy warm water. If the cow can swallow, a dose of 2 ounces of alcohol or ammonium carbonate may be administered, while she should be kept warm with sacks and rugs and propped up on her chest.

If allowed to lie for a long time on one side she will be very likely to develope congestion of the lungs or pneumonia, which will probably be fatal.

If there is no sign of recovery in eight hours the injection of air should be repeated.

Diseases of the Stomachs of Cattle—Tympanitis.

This is not in itself a disease, but is the most prominent symptom resulting from indigestion, due to food eaten under certain conditions, which cause the formation of a large quantity of gas in the rumen, and, consequently, a swelling of the left flank. Cattle turned hungry into any succulent green feed are likely to suffer, thus cases are seen when cattle are first turned into young clover or lucerne, or when travelling cattle gain access to a large quantity of variegated thistle, Cape weed, or any other green herbage, and are allowed to gorge themselves on it. Food eaten hastily, or when very cold, such as potatoes or roots, or even grasses when wet, may also cause it, as digestion is impaired and fermentation set up. It is also seen in choking from any cause, since the gullet being closed, the gases cannot escape, but collect until tympanitis results. The swelling in the flank is very marked, and may rise above the level of the back; it yields to pressure but does not pit, and is painless under manipulation. The animal, however, appears to be in pain, and breathing is very much interfered with; if neglected, the animal will again lie down and die from suffocation.

In a bad case, the easiest and most effective treatment is to puncture the rumen: this is done in the flank on the left side, at a point the same distance from the last rib, the angle of the haunch, and the edge of the loin bones. The best instrument to use is a trocar and cannula, the trocar being a sharp-pointed instrument passing through the cannula; this is thrust into the rumen and the trocar withdrawn, the gases escaping through the cannula. If this instrument is not handy, an ordinary knife may be used, but care must be taken not to let gas get between the rumen and the skin, as it may spread right along the body and cause the death of the animal.

After the gas has escaped the animal should be given a dose of Epsom salts, 10 to 16 ounces according to the size, with a couple of ounces of ginger, and kept on a moderate diet for a few days afterwards.

In mild cases, keeping the mouth of the cow open with a gag, or piece of wood fixed in the mouth and tied in position, will give relief; or the administration of an ounce each of bicarbonate of soda and ginger in warm water.

Impaction of the Third Stomach (Omasum).

This is really a form of indigestion, of which the important feature is the drying and hardening of the food between the folds of the third stomach. It has been given many names, such as "dry-bible," "fardel-bound," and "stomach-staggers."

It often occurs in animals recovering from a severe illness, but many cases are not preceded by any previous disease, and this is probably the most important form. It is due in these cases almost always to errors of diet. It occurs in cattle fed on dry, hard feed, and only given a limited amount of water. Innutritious dry herbage, such as cattle would be eating at the end of a dry winter, is a common cause, and in spring following such a winter when the green grass is growing amongst the dry herbage, outbreaks of it may occur resembling outbreaks of a contagious disease. The symptoms are, diarrhœa followed by constipation, loss of appetite, quickened breathing, signs of pain—such as grinding the teeth, making wild rushes; gradually increasing emaciation. These may last for ten or fourteen days, but in acute cases death occurs much sooner. Long-standing chronic cases are also found where the animal is continuously unthrifty and loses condition. If an animal dies and is opened, the omasum is found to be enlarged and gorged, very firm and resistant; if it is cut into the spaces between the leaves are found packed with quite dry food, while there will be no food in the fourth stomach, but perhaps some watery fluid, sand, and dirt.

If taken in time, treatment may be successful. A dose of Epsom salts (16 oz.) should be given at once, the animal allowed plenty of water, and if there is any appetite give only green feed or bran mashes with molasses or treacle. An enema of soap and warm water is useful, and should be repeated often until the bowels purge thoroughly.

Retention of the Afterbirth and Inflammation of the Womb.

In every large dairy herd there will sometimes occur cases in which a cow after calving does not "cleanse"—that is, she suffers from "retention of the afterbirth." As a rule, of course, the afterbirth comes away quite cleanly, but if it is retained for more than twelve hours steps should be taken to remove it, as it will quickly become putrid and in a few days cause the animal to become seriously ill, while if neglected altogether she may become affected with a chronic disease or become sterile. The first treatment to be tried in such a case is to give the cow a dose of 12 to 16 oz. of sulphate of magnesia (Epsom salts), according to the size of the cow, with 2 oz. ginger, and 2 oz ammonium carbonate. This should be given in a pint of warm water in the usual way. If after this drench has acted the afterbirth is still retained, the cow must be washed out in the same way as for contagious abortion—that is, a piece of rubber tubing about 3 feet long is taken and a funnel fixed at one end; the hands are washed thoroughly in a disinfectant, and the free end of the tube carried into the womb, and some warm disinfectant fluid poured in slowly—any of those recommended for contagious abortion are suitable—until it comes back fairly clear. It will generally be found that the afterbirth will come away under such treatment; and if any of the afterbirth is hanging from the vagina of the cow it may be pulled gently but never jerked or pulled hard, as that may cause excessive bleeding. The cow should be irrigated in this way twice a day until there is no further smell nor discharge of pieces of afterbirth and the disinfectant fluid

comes back from the cow quite clear. If a cow which has not cleansed is neglected, in a few days time there will be a very offensive odour from the vagina; the cow will lose her appetite, will not chew the cud; the milk supply will diminish, and there will be all the signs of fever. The cow is suffering from an attack of inflammation of the womb, or metritis, due to organisms from the putrid afterbirth attacking the womb. A discharge will come from the vulva, sometimes very offensive in odour, blood-stained or pus-like. Treatment is the same as that recommended for retention of the afterbirth—frequent washing-out with warm disinfectants and dosing with stimulants and febrifuges, such as sweet spirits of nitre and alcohol, 2 oz. each, or carbonate of ammonia, 2 oz. twice daily in a pint of warm water or thin gruel.

Besides retention of the afterbirth, inflammation of the womb may be caused by wounds due to difficult calving, or by infection of the womb with dangerous organisms in any way. Many cases end fatally in four or five days, but some cows suffer from inflammation of the womb for a long time, in which case they do not do well and usually have a discharge from the vulva. Such cows are, of course, sterile for the time and will not fatten, and probably the cheapest method of dealing with them is to kill them or leave them to chance, unless expert assistance is available.

Sporadic Abortion.

By this is meant the slipping of a calf before it is sufficiently developed to live, by a single cow in a herd usually from some obvious external cause. As a rule, nothing will be noticed amiss with the cow until the act of abortion takes place, and then the fact will be known only by the finding of the fœtus, but in some cases, especially in the last stages of pregnancy, there are marked symptoms resembling those of normal parturition. In most cases the fœtus is expelled with the membranes, but in some these may be retained, and if not removed may cause serious trouble. It may be due to very many causes, such as disease of the ovaries or womb, as in tuberculosis; severe exertion, such as being driven fast or for a long distance; great excitement; the drinking of very large quantities of very cold water; blows; obstinate constipation; some drugs, such as ergot; and various infectious diseases, nd very often to death of the fœtus from one cause or another.

In many cases the best thing to do is to fatten the cow for the butcher, as she is very likely to abort a second time, but if it is specially desired to breed from her she should be kept away from the bull for at least a year, and then after being put to the bull she should not be allowed to get too fat or too poor, and not submitted to any rough treatment or made to undergo severe exertion. Her bowels must be kept open, if necessary, by a dose of ½ lb. of Epsom salts or a little molasses. It would also be advisable to have her tested for tuberculosis.

Barley.

G. M. McKEOWN, Manager, Wagga Wagga Experiment Farm.

As the demand for malting barley in this State is far in excess of supply, its production may well be increased, especially as, even when not of the best malting quality, it always meets with a ready sale as a fodder grain. The market price of good malting barley is usually far in excess of that of milling wheat, and feed grain rarely falls in value below wheat price.

At the Wagga Wagga Experiment Farm, the soil and climate of which are typical of an immense area of cereal-producing land in the State, the average crop harvested from the best yielding variety of barley during a number of years exceeded that of the foremost variety of wheat by about 7 bushels per acre.

This fact, together with the better prices available, show the desirability of including barley in a system of mixed farming in suitable localities.

One of the features of Riverina-grown barley is its bright colour, a feature which is esteemed by maltsters as of value in the production of bright ales.

The most suitable soil is a light, free loam of fair quality, which should be well worked and reduced to the finest possible condition. If necessary to roll the land, it is preferable to do the work before sowing, as the passage of the seed drill stirs the surface of soil and reduces the possibility of its compacting under a heavy rainfall.

The best time to sow for grain production is in May, and, as in the case of wheat, the best results will be obtained from land which has been fallowed.

Plump seed should be selected, the quantity required for sowing being from 30 to 35 lb. per acre.

The varieties which have proved most successful over a long period are three of the Chevalier type,—Kinver, Golden Grain, and Hallett's Pedigree, while several of more recent introduction, which were raised by Messrs. Webb and Sons, give promise of usefulness. They consist of Giant, Burton, and Binder.

The fertiliser which has given the best results is 60 lb. superphosphate and 28 lb. sulphate of potash, which should be drilled in with the seed. Top-dressing with fertilisers during the growth of crops has proved unsatisfactory in districts having a moderate rainfall. Tests should, however, be carried out from time to time to ascertain what increase in quantities will be necessary.

Harvesting.

Care should be exercised in order that the grain should be thoroughly ripened, but that the straw shall not have reached a degree of ripeness which will cause the ears, which are then in the condition known as "swan-necked," to break off when being cut, as considerable loss would thus be caused.

The sheaves should be promptly stooked to prevent the grain from becoming discoloured by contact with the damp ground in the event of showers falling.

Stooks should be made of moderate size only (not exceeding twenty sheaves), to ensure free circulation of air and rapid drying, should rain fall before the crop is ready to stack.

The best method of harvesting is by reaping and binding the crop, as the grain is improved by mellowing in the stack, and it can be better prepared for sale by threshing and grading in due course

Stacking should be carried out with as little delay as possible after the crop is thoroughly dried, so that it may be secured from adverse weather, as very little moisture at this time will spoil the colour of the grain and thereby considerably reduce its value to the maltster.

Great care should be exercised in threshing to see that the drum of the thresher is allowed sufficient space to prevent the grain from being cracked or closely clipped, as any damage to the skin prevents germination, and further affects its value by causing it to mould in the process of malting. It is preferable that the grain should be bagged with a small portion of the awn adhering rather than that it should be injured by close threshing.

As threshing machines are not everywhere available, there is in some parts no alternative but to use the harvester or stripper, in which case care will be necessary in setting the machines in order to obtain the best results.

Some of the winnowers and graders on the market will be found useful machines for the final preparation of the grain.

Where the quality of the grain is not up to malting standard, it will be found to be of good value as stock food, so that in any case a certain market will be found for it.

The risk of injury to the grain is much greater when stripped than when harvested by reaper and binder.

Barley for Fodder.

Tests have been made of a number of varieties for fodder, but the skinless, or hulless kind may be regarded as the most satisfactory.

The awns of bearded varieties in an advanced stage of growth are liable to become injurious to stock, even when converted into silage, as they dry and stiffen after removal for a few hours from the stack or building in which the fodder may have been conserved.

Beardless varieties have proved to produce very weak straw, which is very liable to "lodge," and although the awns are short they are hard and objectionable when in a forward condition. These varieties do not fully shed the awns in course of threshing, and as the grain is usually thin it does not provide a satisfactory feed grain.

The best variety is the skinless or hulless, the grain of which threshes free from husk and resembles wheat in appearance.

Although not so heavy a straw-producer as the Cape variety, it makes less dead flag, it is better liked by stock, and it may be cut earlier. It is free from beards or awns, and it will thrive under drier conditions. It may, therefore, be used in an advanced stage of growth without injury to stock, provided the grain has not ripened, as, like wheat, if not crushed or cooked it is not easily digested.

For green fodder, seed may be sown from March to May, inclusive, seed being used at the rate of 40 to 45 lb. per acre. Its value is increased by the addition of vetches or peas, which should be sown at the rate of half a bushel to the acre respectively. There is a very large demand for seed for use for producing green fodder for dairy cattle.

For green fodder use 3 qrs. to 1 cwt. per acre of No. 3 manure, the analysis of which is as follows :—13 per cent. water soluble phosphoric acid, nitrogen 3·3, sulphate of potash 3·77.

In favourable seasons the crop may be cut at least once for green fodder, if taken early, and the latter growth allowed to seed.

Brown Rot or Twig Blight (*Monilia fructigena*).

W. W. FROGGATT, Government Entomologist.

This is a very serious disease in some parts of America, causing the fruit to rot just when it should be ripening. It frequently starts in a cluster of fruit where the fruits touch; soon all the fruits turn soft, brown, and rotten, and the decaying surface becomes covered with ash-coloured mould, consisting of countless numbers of microscopic spores. From the fruit the disease spreads up and down the branchlets, which die back, while the foliage becomes dead and yellow as if burnt with a fire.

This disease appeared very suddenly in many different districts just before Christmas, and specimens were sent in to the Department from several places near Sydney; it was recorded from Gosford, and there was a wide-spread infestation all through the orchards along the Hawkesbury River. With the district inspector I visited Sackville Reach early in January, and inspected a number of orchards that were infested. The trees were covered with dead branchlets and dried-up fruits, but the disease had stopped spreading. This was evidently due to the excessive hot weather just after New Year, which had checked the disease. The nectarines suffered particularly from this fungus, and I was informed that in several places the infestation had been so severe that a number of trees had died. The peaches were infested in the same manner, but not to the same extent, while though numbers of Japanese plums were rotten it did not cause the branchlets to die back, but simply destroyed the fruit. This fungus is also known in America as a pest upon cherries.

There are no means of dealing with the fungus when once it has spread on to the ripening fruit if the weather conditions suit it, but all means should be taken to destroy the resting spores of this season, so that it will not appear next year. All diseased fruit and all the dead wood and branchlets should be cut off and carefully burnt. All trees now infested should be marked, and sprayed in the winter with Bordeaux mixture.

Diseases of Stock.

STOCK BRANCH—LEAFLET No. 2.

Bots of Horses.

THE parasites known as "bots," which infest the digestive organs of the horse, are larvæ of certain gad-flies—*Œstridæ.* Five species have been described, all of which have been found in the larval condition in the stomach of the horse, but so far as is known, there are only two species of bot-fly or horse-bee existing in this State. The more common one is technically known as the *Gastrophilus equi.* It is described by Neumann as being a woolly insect, covered with a white silky down, forehead fawn coloured, the posterior parts having black hairs, antennæ rust coloured, thorax sometimes entirely covered with reddish hairs, and most frequently having

a *b* *c*

Fig. 1.—*Gastrophilus equi*—**natural size (Neumann).**
a. Female, dorsal view. *b.* Female, in profile. *c.* Male, dorsal view.

a black transversal band. The abdomen is of a yellowish brown tint, with irregular denticulated brownish grey or dark spots. The wings are transparent, and have in their middle a tranverse smoky band, their posterior extremities having two spots of the same tint. The posterior portion of the male is obtuse, but the abdomen of the female is, on the contrary, extended as a large oviscarp, which is doubled up under that region when at rest. The length of the insect—not including the oviscarp of the female—is about half an inch. The rarer species is called the *Gastrophilus hæmorrhoidalis* and is of a dark brown colour. It somewhat resembles the *Gastrophilus equi,* but is smaller and easily distinguished by its hyaline wings, which do not carry any dark spots.

Distribution.—The species is found throughout Europe, Great Britain, Africa, Asia, North America, New Zealand, and of recent years in Victoria and New South Wales. With regard to its dissemination in this State, the pest was first reported to have appeared in the Bombala district; from there it gradually spread northward along the eastern side of the mountains, it

being successively reported to be prevalent at Nowra, Braidwood, Moss Vale, Camden, Sydney, the Hunter River district, and the North Coast district. Speaking generally, the pest now exists throughout the Eastern Division of the State, and extensively in the Central Division.

Life History.—The fly exists in its perfect state in this country from September to March. The female flies buzzing about the horses during the warmest hours of the day, hovers about for a few seconds over the place where it seeks to deposit its egg, drops an egg on it, and immediately flies away, but soon returns to lay a second egg, and repeats the operation so often that hundreds of eggs may be found on the same horse. The horses of some countries do not appear to be disturbed by the process, but several accidents have occurred in this State through horses bolting when attacked by bot-flies.

a

Fig. 2.

Eggs of the ***Gastrophilus equi.***

On hair *b* is seen a larvule which has just been hatched (Neumann).

b

The eggs are usually deposited under the jaws, on the neck, breast, shoulders, and fore-arms. They are yellowish white in colour, and conical in shape, and about one-twentieth of an inch long. They are transversely striated, and adhere to the hair by the small end, in the same manner as the "nits" of the louse, the wide end carrying the operculum remaining pendant. They hatch out in a few days, and the larvæ escape through the operculum, while the empty shell remains clinging to the hair. The larvæ are vivacious, and begin to crawl on the skin, causing a slight itching, which impels the horse to lick and bite the part. In this way the larvæ gain the mouth, and from there pass with the food into the stomach, where they attach themselves by means of hooklets arranged about their mouth-pieces, and subsist on the inflammatory products secreted by the mucous membrane. The bots remain in the horse's stomach for about ten months, by which time they have reached their maturity. They then detach themselves voluntarily, and passing along with the alimentary matter become expelled with the fæces. As a rule, they are evacuated during the night or early in the morning. At

first they are very lively, and bury themselves in the excrements or in the ground. They remain hidden from thirty to forty days, when the perfect insect or fly emerges. Copulation takes place, and the females in their turn deposit their ova on horses.

The other species of bot-fly is known as *Gastrophilus hæmorrhoidalis.* It is also known throughout Europe, Great Britain, and North America. This fly is distinguishable from the former by its darker colour and its transparent wings, and the absence of spots on them. While its habits are analogous to the *G. equi*, the female prefers laying its eggs on the lips of the horses, the process giving rise to an irritating tickling, which causes the animal to rub its lips against the ground, or on its fore limbs, and often the horse gallops away to evade the attacks of the insect. The eggs are darker in colour, while the larvæ are deeper red, and somewhat smaller, and usually inhabit the rectum, where, as they mature and assume a greenish tint, they may sometimes be seen when the rectum is everted during the act of defecation.

Fig. 3.
Gastrophilus hæmorrhoidalis—**dorsal view, natural size (Neumann).**

Habitat of the Larvæ.—The larvæ of the *Gastrophilus* inhabit horses which frequent pastures or live in the open air, and which do not receive much grooming. It is mainly in the stomach that the larvæ of *Gastrophilus equi* are found clinging in bunches to the cuticular portion of that organ, but they may also be found in the œsophagus (or gullet) above the cardiac opening. In number they vary from a few to hundreds.

Occasionally the larvæ of *G. hæmorrhoidalis* are found inhabiting the glandular portion of the stomach and the duodenum (the first portion of the small intestines), and they are constantly found in the rectum, where they remain some time before passing out.

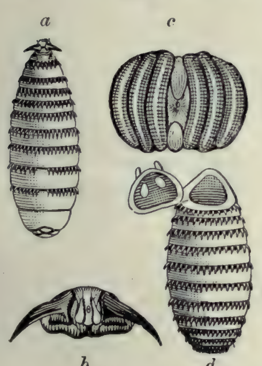


Fig. 4.—Larva and pupa of the *Gastrophilus equi.*

a. Larva.
b. Portion of head.
c. Its posterior stigmates.
d. Pupa, showing operculum. (Delafond).

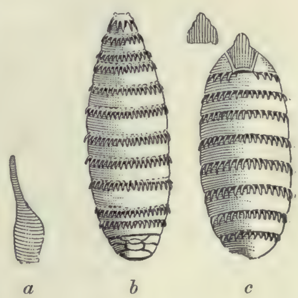


Fig. 5.
Gastrophilus hæmorrhoidalis.

a. The egg.
b. Larva.
c. Pupa with its operculum. (Neumann).

Effects produced by the Larvæ.—At the point where a larva attaches itself it produces a small circular sore or depression in the mucous membrane, around which is a circumscribed inflammatory area.

As regards the ill effects the larvæ may have on the health of their hosts, many divergent opinions exist. Certain authorities have attributed most serious consequences to them; but when we reflect on the extreme frequency of the gastric larvæ, the multitude of horses infested with them, and their frequently being present in enormous numbers in the stomach without even being suspected during life, owing to the absence of any apparent disturbance, we might be led to believe that they are altogether inoffensive. Still, one cannot examine the numerous sores they produce on the interior lining of the stomach without admitting that the functions of that organ must have been interfered with by the excessive irritation that had been going on. Interference with the function of the stomach produces indigestion, which often leads to colic of a fatal kind. Affected horses commonly have a hide-

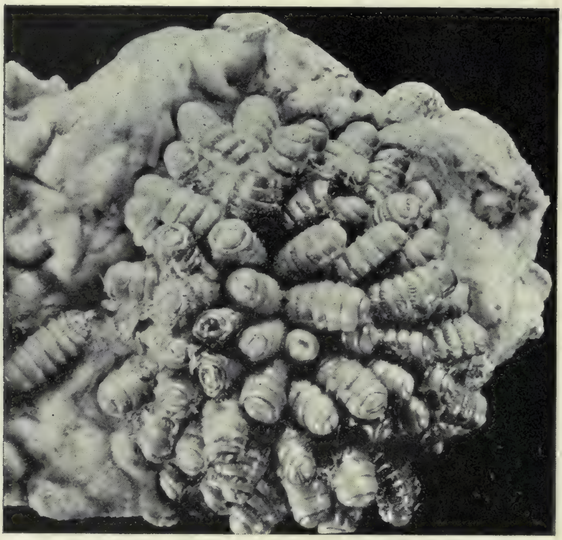


Fig. 6.—A cluster of larvæ of *Gastrophilus equi* attached to the cuticular portion of lining membrane of stomach of horse.

The area surrounding the cluster shows an ulcerated surface from previous infestation with stomach bots.

bound emaciated appearance, notwithstanding the fact that they possess capricious, though irregular, appetites. When larvæ of the *Hæmorrhoidalis equi* inhabit the glandular portion of the stomach and the duodendum, they sometimes give rise to inflammation, followed by perforation, leading to peritonitis and death. Owing to the irritation of larvæ in the rectum, the animal often makes violent efforts during defecation.

Curative Treatment.—A great number of drugs have been tried to effect expulsion of the larvæ or bots from the stomach of the horse without satisfactory results being obtained. In endeavouring to remove the larvæ acute inflammation of the stomach has been produced, which caused the death of the animal, and yet on a *post-mortem* examination the bots were found,

apparently, unaffected. This is mainly on account of the manner in which they bury their heads and also owing to the toughness of their skin.

There are a great many remedies used, many having gained a reputation through being administered at a time when the larvæ were naturally leaving their host. In some parts of England affected horses are drenched after a period of starvation with defibrinated sheep's blood, with the object of causing the bots to overgorge themselves and relax their hold, so that the medicine subsequently administered might be more effective. Iron filings and ground glass mixed with lard have been given in the form of a ball some hours before drenching, the idea being to wound the bots and render them more susceptible to the action of the drugs.

The most common and safe remedy is from 1 to 2 oz. of turpentine mixed with the white of an egg and given in 1 to 2 pints of raw linseed oil on an empty stomach. Though not wholly efficacious, its administration is often followed by the expulsion of a number of bots. Bisulphide of carbon given in ½ oz. doses in capsules frequently dislodges a number of stomach bots. Perroncito gave two capsules containing ¾ oz. of bisulphide of carbon eight times a day, at intervals of two hours, and followed next morning with 150 grains of tartar emetic, and he claims to have had very satisfactory results.

The following treatment has been reported to have given good results in this State—*i.e.*, after starving the animal for at least twenty-four hours, give 1 quart of molasses or dissolved sugar in a quart of milk, and in thirty minutes give 2 oz. of alum dissolved in 1 quart of water, followed in about an hour by a quick-acting laxative, such as ½ lb. of Epsom salts, or 2 pints of raw linseed oil.

There are other treatments that are practicable only in the veterinary hospital. For instance, that of Fleming's, who recommends, after twelve hours' fast, 2 drams of aloes and assafœtida dissolved in hot water, to which is added, when cold, ½ oz. each of turpentine and sulphuric ether; the mixture to be administered in a pint of gruel, and repeated for several consecutive days. He also recommends 1 oz. tincture of iodine in 2 oz. each of glycerine and water to be given as a drench on an empty stomach.

When the *Hœmorrhoidalis equi* are located within the rectum they may be removed surgically.

Preventive Measures.—The difficulty of removing the bot from the stomach of the horse accentuates the necessity of exercising preventive measures in a thorough manner. In some countries horses are hooded and rugged with light clothing, or are provided with fly-nets and tassels which play over the parts usually attacked. A piece of rag saturated in some anti-fly-strike preparation and suspended from the throat-strap is often of considerable benefit. As a substitute for clothing, various applications have been tried, but, unfortunately, none retain their power for any length of period. Consequently, it is necessary to frequently examine the horses running loose on pastures and repeat the dressing as required.

The applications most commonly used for dressing the parts of the horse usually struck by the bot-fly—*i.e.*, under the jaws, on the breast and forelegs—are substances possessing a pungent aroma, such as tincture of assafœtida, creolin, oil of rue, train oil, and fish oil—the latter is usually most effective, as it retains its aromatic properties for a longer period. Oil of creosote, 1 part mixed with 10 parts olive oil, or rape oil, is also very effective. Frequently, flour of sulphur is added to the foregoing.

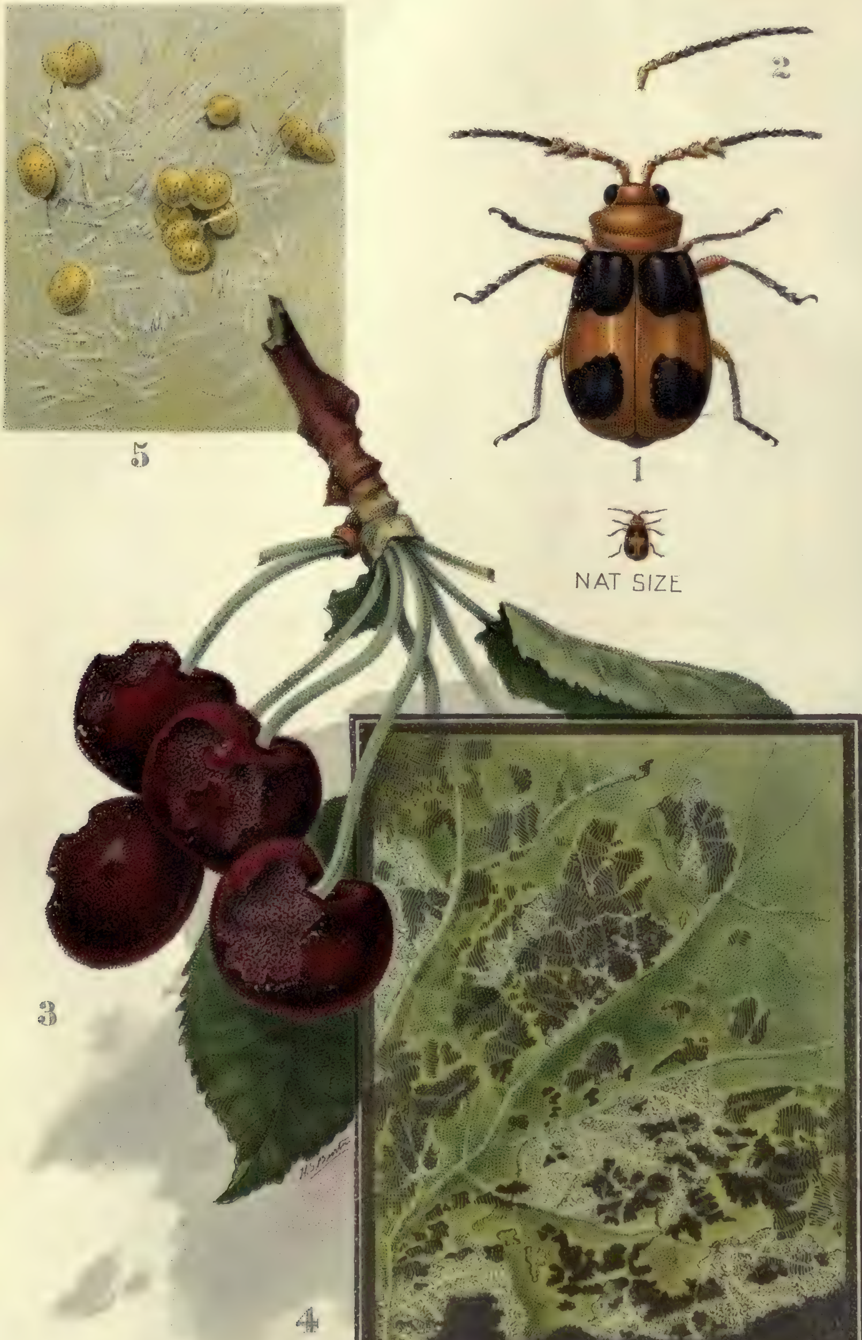
In the case of horses in actual work, and particularly those that are stabled and groomed, there is no great difficulty in keeping them free from bot infestation, as the eggs may be removed during the process of grooming, and the affected parts washed with a solution of ordinary carbolic dipping-fluid—1 part to 30 parts of water. This has the effect of destroying the vitality of the attached eggs and the young larvæ.

As far as we are aware, no bird has acquired an epicurean appetite for the bot-fly, and it would appear that the eradication of the fly can only be effected by destroying the larvæ as they are passed out in the fæces.

Nitrogen-fixing Bacteria.

Mention was made in the "Message of the Minister of Agriculture to the Agriculturists of New South Wales," published in the January number of this *Gazette*, of the establishment of the Bureau of Microbiology, and the assistance it was hoped would be obtained therefrom by this Department and farmers generally. The plain, practical farmer may hurriedly pass over any mention of the word "bacteria," as being too highly scientific to have any immediate bearing upon his following; but, nevertheless, bacteria play a very important part in his vocation. There are a number of bacteria which live in the soil, and form little nodules on the roots of peas, beans, vetches, clover, and lucerne, which draw upon the nitrogen in the air and store it in the roots and stems of the plants. Nitrogen is the most expensive food element, and inoculation will furnish all the nitrogen necessary for leguminous crops at very small cost.

The Director of the Bureau of Microbiology has already under cultivation cultures of nodule bacteria of peas and sweet peas, beans (Lima, butter, and ordinary dwarf), broad beans, and trifolium, and supplies are now being forwarded from the experiment farms of plants of vetches, lucerne, soy beans, cowpeas, lupins, or red clover, and other legumes, from which the bacteria may be cultivated.



ORIGINAL, DRAWN FOR THE AGRICULTURAL GAZETTE. W. A. GULLICK, GOVERNMENT PRINTER.

LIFE HISTORY OF PUMPKIN BEETLE, AULACOPHORA OLIVIERI.

1. *Aulacophora olivieri. Guer. (enlarged).* 3. *Cherries damaged by beetles.*

The Banded Pumpkin Beetle (*Aulacophora oliverei*, Guéren).

WALTER W. FROGGATT, Government Entomologist.

Introduction.

THERE is no record in any report or agricultural journal as to when this very common bettle was first noticed as a pest upon cultivated melons and pumpkins, nor do we yet know much about its life history or its native food plants.

It was first figured in a rather poor woodcut in the fourth volume of the *Agricultural Gazette* of New South Wales, 1893 (page 379), by Mr. Olliff, to illustrate a paper he wrote, "Report on a Visit to the Clarence River District for the purpose of ascertaining the nature and extent of the insect ravages on the Sugar-cane crops."

In this paper he says: "In addition to the foregoing beetles, three plant-eating species were found, namely, the common northern plant-eating lady-bird, *Epilachna guttatopustulata*, Fab.; the Banded Pumpkin Beetle, *Aulacophora hilaris*, Boisd.; and the two-spotted Monolepta, *Monolepta rosea*. All these beetles injure the cane by eating the young leaves and buds.

It was certainly well known as a pumpkin beetle even at that date, and in 1898, in "Notes on the Northern Rivers" (*Agricultural Gazette*), H. V. Jackson said: "In the early stages of growth pumpkins and marrows suffer from the attacks of leaf-eating beetles, or so-called 'ladybirds or bugs,' one a black and yellow bug (*Aulacophora hilaris*) is very persistent on pumpkins."

In the "Insect and Fungus Pests of Fruit-trees and their remedies" (Miscellaneous Publication, No. 238), the woodcut of the pumpkin beetle was again reproduced, with a very brief description of the beetle. The pumpkin beetle was identified by Olliff as *Aulacophora hilaris*. This beetle was described by Boisduval in 1835, but according to the Catalogue of Australian Cleoptera, this is a synonym of *Aulacophora analis*, which was described by Weber from Sumatra in 1801. Specimens sent some years ago by me to the Rev. T. Blackburn were d-termined by him as *Aulacophora oliverei*, Guéren, though the latter described it under a different genus; therefore, when writing my book, "Australian Insects," I placed it under the latter name.

There are over sixty members of the genus *Aulacophora*; they have a wide range from India through the Malay Archipelago, New Guinea, New Caledonia, and Australia, and all in the beetle stage feed upon the foliage of plants.

Description.—The adult beetle is of a general rich orange yellow colour, marked with black; it measures about a quarter of an inch in length. It is rounded on the upper surface, and can be easily distinguished from the true ladybird beetles by its general form being elongated, and the thorax forming a neck between the head and body, whereas in the ladybirds the head and thorax fit so closely into the hind portion that the whole is almost circular. As there are a number of closely-allied species, the following more detailed description will enable any one who has the beetle before him to identify it: Colour—Upper surface rich orange yellow, with the first three basal joints of the long eight-jointed antennæ yellow, and the five terminal ones black. The prominent rounded eyes are black, so also are the jaws; though the thorax is apparently all yellow, the edges are finely marked with black. The wing-covers, narrow behind the shoulders, or hind margin of the thorax, are elongated and broadly rounded to the extremities, are of a rich orange yellow, with the base a broad transverse band across the lower half of the wing-covers, a faint dorsal stripe towards the tips, and the whole of the tips rich blue black. On the under surface the shanks and feet (tibiæ and tarsi) are black, with the segment between the middle and hind legs black, so that connected with the black blotches on the wing-covers it forms a continuous band round the body. The last two segments of the body are all black on the under surface, but on the upper surface the first of them is barred with yellow on either side.

Eggs.—In captivity the eggs are laid either upon the soil in the jar, or upon the remains of the food; they are attached to this by a little yellow secretion, so that under the lens they often look as if they were stalked. They are irregularly oval in form, and finely granulated with an irregular network pattern. About as big as a pin's point, they are still easily seen with the naked eye. In dissecting a number of females, the number of eggs obtained varied from sixty to seventy. These eggs had been kept under observation for a week, when the tiny larvæ began to hatch out and crawl about on the sand in the bottom of the jar; but they could not be induced to take to any vegetable food, and within a few days had all died.

The larvæ are dull yellow coloured, little elongate grubs, with the hind portion yellow. They are somewhat cylindrical in form, and have three pairs of well-defined legs and prolegs on the anal segment. A few long hairs and numerous fine hairs are scattered on the head and tip of the body.

Habits.—This is certainly the worst leaf-eating beetle that gardeners have to deal with, for it attacks all kinds of melons, cucumbers, pumpkins, and squashes. They usually appear in the garden just as the plants have made a good start, and if their ravages are not noticed the plants are soon destroyed. In an ordinary season they appear about the middle of October, and remain, and are at their worst until the middle of November. They swarm on the upper surface, gnawing away the upper surface of the leaf, and eating off the soft tissue until nothing but the dried skeleton of the leaf is left; then they start on the next leaf. The flowers are also attacked

from the edges, and eaten off in the same manner; so that if they are allowed to take possession the plants, even if they recover, have but little chance of producing a crop.

Remedies.

If the plants are dusted on the upper surface with a plentiful supply of wood ashes, lime, or even fine road dust, the beetles will, in most seasons, leave the plants alone. Last year, however, they were exceptionally bad, and many correspondents state that ashes and lime will not drive them away, so that the only remedy now seems to be the use of some arsenical spray or dust.

Paris green dusted over the foliage will drive the beetles away. Specimens kept in a jar with dusted leaves did not touch those treated with Paris green. The habits of this beetle are very similar to those of the Potato Bug or Colorado Beetle, that at one time threatened to destroy the potato crops of the United States, but to day is kept under control by spraying and dusting the potato fields with Paris green.

They could also be collected upon the foliage in the early morning, with a net or sheet, and destroyed in large quantities with a little trouble. Before the sun gets up nearly all insects are more or less torpid, and can be shaken off plants, and if a little kerosene oil and water in a shallow dish is placed under the large infested leaves before they are shaken, it would kill them in one act. Of course, all these things mean extra work, but it is better than replanting when the first plants are ruined, as is often the case.

The Pumpkin Beetle as a Fruit Pest.

The last season was one of the worst experienced all over the country, even in the suburban gardens around Sydney, and it appears as if this beetle was not only getting more abundant, but is also spreading southward every year. This year it has been recorded as a fruit pest, though several orchardists in the Tamworth district informed me that for several years they have known it to damage fruit.

Towards the end of last year (1908), my attention was first called to this new departure of the pumpkin beetle by Inspector D. E. Howard, who sent me down a packet of damaged cherries, the work of this beetle. My observations were made a few days later in the same orchard.

There was a row of about a dozen cherry-trees along the edge of a field, and there was hardly a sound cherry in the whole crop. Under the trees there were hundreds of dried cherries, only stone and stalk, and those hanging on the trees had holes gnawed all over them. The pumpkin beetles had left them, however, about three days before, as the large mound ants (*Iridomyrmex detectus*), attracted by the fallen fruit, had swarmed into the cherry-trees and finished up the damaged cherries, but as soon as the hot sun began to shrivel the fruit the ants left the trees, and were succeeded by swarms of little yellow ladybird beetles (*Verania frenata*), which, when I arrived, were flying round the trees like a swarm of bees, and were busily engaged eating the decaying fruit still hanging on the trees.

Ants have been often known to attack damaged fruit, but this is the first time that the writer ever heard of carnivorous ladybird beetles of any kind going for fruit diet. Specimens of these ladybird beetles, kept in observation jars, lived for several weeks upon the damaged cherries as if they were their natural food.

These are very interesting observations of Inspector Howard's, for if any one had come into the orchard after the pumpkin beetles had gone, and found the ants swarming over the cherries, they would have been positive that the ants had caused the damage, while if another person had come along later, and found the ladybird beetles in possession, he would have immediately said that the latter beetles were the culprits.

On making inquiries among the orchardists, I found that the pumpkin beetles had been noticed the previous year upon the ripening cherries, and it was quite a common thing to find them in numbers upon the apple-trees, where they clustered round the stalks of the young apples, and gnawing them, caused the apples to fall.

If the acquired habit spreads, the pumpkin beetle may become one of the most serious fruit pests, and when it attacks ripening fruit like cherries, will be a very difficult one to deal with.

Whey Butter.

A Whey butter factory is, according to the *Live Stock Journal*, the latest development of dairying in the United States. The factory itself has been erected at St. Lawrence, Jefferson county, New York, and during the past season has been receiving the separated whey cream from twenty-five other cheese factories. The experience gained is that about 4 lb. of whey butter can be made from every 1,000 lb. of whey, and that this utilisation of the whey solves the problem of the loss of fat in cheesemaking. Where the butter has been put on the market its fine flavour has made it very popular, so that it obtains the same price as the finest creamery butter. As a result of selling the separated whey cream the cheese factories have been able to make rather more than a penny more for every 100 lb. of milk; while the separated whey is said to lose none of its value for pig-feeding.

Milk Standards.*

Composition of Australian Cows' Milk.

M. A. O'CALLAGHAN, Chief Dairy Expert.

ALMOST all writers and speakers of recent date have attacked the milk question from the consumers' point of view only; and statements have been made which have done more to retard than to encourage progress. It goes without saying that any judgment given which is not equitable, or any opinions expressed which have not got solid fact for their bases, must bring about that dissatisfaction which causes a reaction rather than a progressive movement. Accuse an innocent man of any charge, and repeat the accusation sufficiently often, and in time you will find a sour, disheartened person. Now, if our dairy farmers are even occasionally accused of sins which they do not commit, it goes without saying that we shall, instead of getting their best efforts towards improvement, only bring about a disbelief in the teachings and work of scientific men. For this reason it becomes absolutely necessary, if we are to make any progress towards improving the quality of our milk, to understand the position thoroughly ourselves as teachers; and then we may be able to demonstrate error, and convince the farmer of the necessity for better things.

The Present Position.

Let us review the position somewhat:—

The consumer or his agent purchases from the farmer cows' milk. Well, what is cows' milk? We might define it as the whole of the fluid secreted by the healthy mammary glands of the cow.

If the farmer supplies us with this in an unadulterated condition, we can have no quarrel with him unless there is something more definite in the way of standards mentioned in the contract. If the farmer then sells his milk as drawn from the cow, and an analyst presents him with a certificate that such milk contains a certain percentage of added water, the farmer, not knowing the basis from which the analyst drew his conclusions simply believes that the chemist does not know his business, and this belief makes it more difficult to get such a farmer to follow in any way the teachings of science.

Thus it is that in this stage of the dairying industry in Australia it is rather important that if milk standards are to be fixed they shall not only be equitable but shall be workable ones, and the standards on which the analyst bases his conclusions should be clearly shown on every certificate of analysis. The farmer (and frequently the presiding magistrate) does not know that the analyst does not absolutely find water in the milk apart from that yielded by the cow; and does not dream for a moment that the analyst assumes that normal milk contains a certain percentage of solids not fat, and that if the

* This Paper was read at the Australasian Science Congress, Brisbane, January, 1909.

milk in question does not reach that standard the analyst concludes that water has been added. In many cases, instead of stating that the milk contains added water, the correct and educational thing to do would be to inform the farmer or milk seller that his milk is below the standard in a certain way, and pointing out on said certificate the probable cause of the deficiency. This is a young country, and dairying is practically a young industry here, and we must not assume that farmers and members of the general community know all about milk analytical standards and methods.

Milk Composition.

Hitherto we have been accustomed to accept, I am afraid, the old theory handed down by workers (in countries where the seasons are regular, and where droughts are unknown) that the fat is practically speaking the only constituent of the milk which varies to any extent, especially in a herd of more than two or three cattle; whereas I have reason to believe that investigation will show the solids other than fat are materially affected by continued droughts, such as experienced repeatedly in different parts of Australia. I am driven to this belief by actual results obtained from milk produced in New South Wales, and I am supported in this opinion by observations in the United States, made during a drought, or what they consider over there a drought.

About ten years ago I made rather an exhaustive inquiry into the milk produced in New South Wales from one point of view, namely, its fat contents, and arrived at the conclusion that in New South Wales milk was up to, if not above, the average milk produced in other countries from this point of view. The actual figures worked out at 3·88 per cent. This represented the mixed milk of many thousands of cows as supplied to butter factories in New South Wales about ten years ago. At that time I had no reason to believe our milks were not equally representative in solids not fat. In latter years, however, we have been experiencing rather persistent droughts throught the area which generally supplies Sydney with milk for human consumption as milk; and a number of complaints have been made regarding the milk supplied by farmers, who appeared from all ordinary standpoints to be above suspicion. One of these complaints was sent to a well-known farmer, of some means, in the county of Cumberland, and, as a consequence, he brought various samples of his milk to my laboratory for analysis. These proved to be so low in solids not fat, while above the ordinary standard for fat, that I decided to make further investigation, and accordingly visited the farm myself, when I found the cows to be crossbred with a good deal of the Jersey strain through the greater number. The drought conditions were severe, and no green-food had been available for months, but the animals were being hand-fed on chaff and bran, and appeared in very fair condition. Samples were taken and, to make assurance doubly sure, I sent my chief field-assistant to the dairy to take samples there, and see that all milk was thoroughly mixed before sampling. The results given below on the 4th and 5th September, 1906, show that even with those cases when special samples were taken the solids not fat of the milk were extremely low. In

one case, that of the night's milk, solids not fat fell below 8; whereas the fat reached 4·90 per cent. Observations were continued, with varying results, right up to the end of the year 1906, as is seen in the table given below:—

Milk Samples from County of Cumberland farmer, New South Wales, above referred to.

Date.	Total Solids.	Solids not Fat.	Fat.	Remarks.
20/7/06	13·40	8·40	5·00	Morning's milk, sixteen cows, ·74 per cent. ash.
18/8/06	11·38	8·18	3·20	
4/9/06	12·82	7·92	4·80	From milk of fifty-five cows. Night's milk. Sample taken by Mr. Pedersen.
5/9/06	12·02	8·27	3·75	From 8-gallon can. Morning's milk. Sample taken by Mr. Pedersen.
5/9/06	11·70	8·30	3·40	From 10-gallon can. Morning's milk. Sample taken by Mr. Pedersen.
7/10/06	12·42	8·42	4·0	Night's milk.
7/10/06	12·27	9·27	3·0	Morning's milk.
6/11/06	12·22	9·00	3·20	
6/12/06	12·36	8·16	4·20	Night's milk.
8/12/06	11·14	7·84	3·30	Morning's milk.

When it is considered that these figures were obtained from a herd of at least fifty cows, one has to do some thinking before recommending that the solids not fat should reach 8·5 as a minimum in any legal standards that are adopted. In fact, whatever standard is adopted in any State, in my opinion it should carry with it an appeal to the cow on similar lines to the system now adopted in England.

Following the matter up, I have caused frequent observations to be made of the milk supplied by the different breeds of cattle at the State Stud Farm, near Berry, where animals of all breeds are stationed, the cattle being all the progeny of imported stock on both sides.

In the district of Berry we have had for two years now what we might term a summer drought. Rains have been heavy during the winter on each occasion; but no spring rains fell either in 1907 or 1908 on that part of the South Coast, the result being that cattle have had rather a trying time; but their condition, of course, has been kept up by the aid of hand-feeding. Green feed has, however, been scarce, and the general conditions might be described during the entire summer of 1907, and the present summer so far, as abnormal.

The following figures represented the milk of the different breeds stationed at Berry last winter, namely, in July, 1908:—

No. of Cows.	Morning's Milk.		Evening's Milk.	
	Fat.	Solids not Fat.	Fat.	Solids not Fat.
	per cent.	per cent.	per cent.	per cent.
Jerseys, 6	4·70	8·96	5·16	8·83
Holsteins, 8	2·90	8·44	3·95	8·19
Guernseys, 6	3·77	8·81	4·87	8·49
Ayrshire, 1...	2·86	8·39	3·81	8·31
Shorthorn, 1	3·45	8·13	4·00	7·84

With reference to these figures, it might be stated that, in addition to analysing the mixed milk of each breed morning and evening, individual samples were taken from each cow and analysed, and the results, when calculated out, agree as nearly as possible with the actual results of the mixed milk, so that not alone is the correctness of the analytical work substantiated, but the representative character of the samples also.

Looking through the breeds, it was found that of the Jerseys none absolutely fell below 8·5; but two cows in the evening's milk fell as low as 8·5 solids not fat. Amongst the Holsteins in the morning's milk, five out of eight fell below the 8·6 standard, while in the evening's milk, five also fell below 8·5 in solids not fat. Amongst the Guernseys two cows fell below 8·5 in solids not fat, evening's milk, notwithstanding the fact that in each of those cases the fat percentage was above 5.

During the months of June and July I caused samples of milk to be taken by my field officers from representative herds in several districts in New South Wales, where conditions were good, the results of which are shown in the following table:—

Sample.	Date.	No. of Cows.	Morning.			Evening.		
			Total Solids.	Fat.	Solids not Fat	Total Solids.	Fat.	Solids not Fat.
			%	%	%	%	%	%
Bowral District	10/6/08	36	12·81	3·95	8·86	13·42	4·55	8·87
Denman do	23/6/08	31	13·84	4·37	9·57	14·64	5·47	9·17
Do do	25/6/08	13	13·00	3·95	9·05	13·54	4·80	8·74
Do do	28/6/08	40	13·33	4·05	9·27	14·47	5·30	9·17
Coraki do	2/7/08	42	11·60	3·70	7·90	12·22	4·20	8·02
Singleton do	11/7/08	50	12·66	4·10	8·56	13·50	4·90	8·60
Do do	11/7/08	72	12·54	3·80	8·74	13·20	4·57	8·63
Alstonville	25/6/08	35	12·78	3 82	8·96	13·39	4·80	8·59

Looking at these figures, which are representative of some of the best herds of cattle, it is seen that in the morning's milk in only one case did the mixed milk of the herd fall below 8·5, and the cows in this herd were to a great extent half-bred Holsteins. The same herd was at fault in the evening's milking; but it is seen that three others were only slightly above the 8·5 standard; and when we consider those figures it will be also well to bear in mind that the dairy farmers represented were all butter-makers, and it will be only natural to expect that they would keep a class of cows especially adapted for the production of good butter yields, whereas the dairy farmer who devotes his special attention to the sale of milk for town supply selects the animal which gives a large quantity of milk as a matter of the first importance.

Further interesting results.

SAMPLES of milk obtained on Berry Stud Farm on January 7, 1909, after a drought of about four months.—

Breed.	Total Solids.	Fat.	Solids not Fat.	Ash.	No. of Cows.
Guernseys—					
1. Morning	13·52	4·45	9·07	·76	Two.
2. Evening	13·77	5·05	8·72	·70	
Jerseys—					
3. Morning	14·18	4·75	9·43	·61	Seven.
4. Evening	14·26	5·55	8·71	·68	
Holsteins—					
5. Morning	11·86	3·27	8·59	......	Five.
6. Evening	11·97	3·72	8·25	......	
Ayrshires—					
7. Morning	11·31	3·15	8·16	......	Four.
8. Evening	11·42	3·18	8·24	......	
Shorthorns—					
9. Morning	11·42	2·80	8·64	......	Four.
10. Evening	11·40	3·27	8·13	......	

The above milks were tested by Mr. Ramsay, Chief Assistant Chemist, Agricultural Department, and myself in conjunction, while all the previous ones were analysed by my late assistant, Mr. P. C. Denston—a very accurate worker, who had ten years experience of special dairy chemistry.

The figures given in this last table are valuable, because the district in which these cattle are stationed had gone through a severe summer drought, and there is no such thing as green grass at present available. It will be seen that only the Guernseys and Jerseys yielded milk which would come up to the standards in solids not fat, whereas only in one case—that of the four Shorthorn cows—did the milk fall below the standard of 3 per cent. All the figures given draw attention to one point, namely, that the evening's milk, though richer in fat, is, as a rule, lower in solids not fat than yielded by the same cows in the morning. The animal yields a certain amount of solid matter in the day, and gives a higher proportion of solids not fat in the morning than she does in the evening.

Before concluding, I should like to quote a short paragraph from Leffmann and Beam's work on Food Analysis :—

"The average of nearly 100 determinations at the University of Wisconsin creamery during a protracted drought in 1895 gave but a trifle over 8·5 per cent. solids not fat. The casein was low in this milk, while the sugar was about normal in amount. Similar conditions have been observed by Van Slyke at the New York Station."

I wish it to be distinctly understood that I am not advocating a low standard for milk. If there is to be an Australian standard, it should not be lower than 3 per cent. of fat and 8·5 solids not fat; but it should provide for an appeal to the cow within three days from the taking of the sample on which prosecution is proposed, should the farmer demand it; and in every instance the farmer should give a warrant to the selling or distributing agent that the milk as supplied was pure.

LATER RESULTS.

The above paper, which was read at the recent Science Congress at Brisbane, brought forth a good discussion, and when the Government Analyst for Brisbane gave his results of all experimental work done towards using the freezing point of milk as a means of determining the presence of added water, it was seen that by this method milks which would have been condemned as watered under the ordinary analytical methods were found to be simply abnormally poor milks. This really went to prove my contention regarding milk standards, although the paper was not given in that conection. Whereas, Queensland milks as supplied to Brisbane, at least, are represented as extra rich, especially in fat, it was found that the milks of some herds containing some pure and grade Jerseys were below the usual standard in solids not fat, namely, 8·5 per cent.

Following on the work previously done, I have caused observations to be made on the milks supplied by the different breeds at the Berry Stud Farm, and as the drought continued until quite recently, I have had an excellent opportunity of getting results, which I deem of considerable value. I have also samples of milk obtained from herds in other districts, and from the herd of Ayrshire and Shorthorn cattle at the Grafton Experiment Farm, a district which has not been well treated in the way of rain during this summer.

The results, as will be seen below, go to prove the necessity for a very full consideration of this question of milk standards before an absolutely hard and fast standard can be made for Australia, or even New South Wales, without running the risk of doing an injustice to many dairy farmers who raise milk for the purpose of supplying towns and cities.

Fat is the most valuable constituent in milk, and the figures which I have obtained go to show that in the mixed morning's and evening's milk of a herd, there will be very little danger of injury to a dairy-farmer with a 3·0 per cent., or even a 3·2 per cent., fat standard. The chief and almost only danger lies in the standard which shall be adopted for solids not fat. It seems reasonable to allow an appeal to the cow in cases of doubt, because even with the latest additional methods for determining whether water has been added to milk or not, cases will occur when a doubt must exist.

Total Solids as a Standard.

Figures which I have already given and those in the totals below indicate that when the evening's milk falls below the usual standard in solids not fat, the milk is considerably above the accepted standard for fat, and thus the total solids would be equal to the combined standards solids not fat and fat, namely, say 11·5 per cent.

There is no reason why a sliding scale should not be adopted, and if, for instance, as is shown in some of the cases here, the milk yields 4·0 per cent. of fat and 8·21 per cent. of solids not fat, there is no reason why, unless it can be proved that water is added, the deficiency in solids not fat should not

be made up for by the additional fat, and the farmer allowed the benefit of the doubt, because he is really supplying a milk considerably above the standard in total solids, and specially in the most valuable constituent of milk, namely, butter fat.

The utmost care has been taken by Mr. Ramsay, Assistant Agricultural Chemist, in making the determinations given below, and as they agree with the results obtained right through from the same cattle, they carry still more weight when the question of standards is being considered, for here we have not got any up and down business. We have got a constant depression of solids not fat during this period of drought.

The figures obtained on the 3rd February at the Berry Stud Farm, a couple of days after 3 inches of rain had fallen, and when the grass had just begun to shoot, also are educational from another point of view, because milks from the same cows and breeds analysed a week previous show a still further depression in the solids not fat, specially in the case of the Ayrshires and Shorthorns.

The milks obtained from Grafton Farm are worthy of special note, because this is the mixed milk from a fairly large herd of cows, mostly Ayrshires and Illawarra Shorthorns; yet it is low in solids not fat.

Two samples obtained from the herd at Coolangatta, consisting of four Jerseys and seventeen Ayrshires, though very rich in fat, only just maintain the standard of solids not fat in the evening's milk.

ANALYSIS of ten samples of milk, Berry Stud Farm :—

	Ayrshire.		Shorthorn.		Holstein.		Jersey.		Guernsey.	
	Mixed. Morning.	Mixed. Evening.	Mixed. Morning.	Mixed. Evening.	Mixed Morning.	Mixed. Evening.	Mixed. Morning.	Mixed. Evening.	Mixed. Morning.	Mixed. Evening.
Total solids...	12·26	11·77	11·33	11·69	11·60	11·88	14·19	14·42	13·45	14·34
Solids not fat	8·81	8·13	8·58	8·04	8·40	8·21	9·27	9·07	9·11	8·94
Fat	3·45	3·64	2·75	3·65	3·20	3·67	4·92	5·35	4·34	5·40
Ash	·66	·65	·63	·70	·71	·64	·65	·70	·71	·68

Weather dry, grass scarce, only food given is grass. Cattle appear healthy and in fair condition. Samples taken on January 27th, 1909.

ANALYSIS of six samples of milk, Berry Stud Farm:—

	Ayrshire.		Holstein.		Shorthorn.	
	Mixed. Morning.	Mixed. Evening. 3/2/09.	Mixed. Morning.	Mixed. Evening. 3/2/09.	Mixed. Morning.	Mixed. Evening. 3/2/09.
Total solids ...	11·88	12·26	11·39	12·21	11·10	11·62
Solids not fat ...	8·44	7·91	8·21	8·21	8·40	7·92
Fat	3·44	4·35	3·18	4·00	2·70	3·70
Ash	·66	·65	·66	·66	·71	·66

Three inches of rain fell a couple of days before samples were taken. The grass had begun to shoot. The date was February 3rd, 1909.

ANALYSIS of four samples of milk from Grafton :—

	Bulk samples.		Bulk samples.	
	Morning.	Evening.	Morning.	Evening.
Total solids	12·32	12·20	11·94	12·61
Solids not fat	8·57	8·47	8·30	8·48
Fat	3·75	3·73	3 64	4·13
Ash	·68	·66	·70	·72

ANALYSIS of two samples of milk from Coolangatta :—

	Morning milk. 5/2/09.	Evening milk. 4/2/09.
Total solids	12·80	12·94 per cent.
Solids not fat	8·65	8·55 ,,
Fat	4·15	4·39 ,,
Ash	·72	·70 ,,

These cattle are in first class condition and have the run of good paddocks. It is seen all the Ayrshire, Holstein, and Shorthorn samples fell below the standard on February 3rd. The second lot of Grafton samples were taken on February 4th, 1909.

Useful Australian Plants

J. H. MAIDEN,
Government Botanist and Director, Botanic Gardens, Sydney.

No. 101. *Sporobolus Benthami*, Bailey.

The author describes this grass in the following words :—

S. Benthami, Bail. (After Geo. Bentham, author of the "Flora Australiensis").

Stems wiry, erect or trailing ; the erect stems sometimes bearing adventitious tufts at the nodes, which soon disarticulate and falling upon the damp land take root and thus produce fresh plants ; the trailing stems often extend a considerable distance and produce plants in a similar manner to the common strawberry.

The leaves of the erect stems are often quite filiform, but they are very thin and often 1 line broad on the trailing stems.

The inflorescence is a very narrow, loose, spike-like panicle 2 to 4 inches long.

Glumes narrow and nearly or quite transparent. The whole plant is pale-coloured.

(Botany Bulletin, No. XIII, p. 16. April, 1896.)

Synonym.—Bentham's *S. virginicus*, var. (?) *pallida* is a synonym, and is described by Bentham himself in the following words :—

Var. (?) *pallida*, Benth. Taller, often about 1 foot high, leaves narrower, and often more erect ; *spike looser*, 2 *to* 4 *inches long*, the spikelets often small and pale-coloured. Found on the Richmond and Darling Rivers in this Colony ; also in Queensland and Northern Australia. (B.Fl. vii, 621.)

And he refers to the following specimens :—

North Australia.—Gulf of Carpentaria, *R. Brown* ; Sturt's Creek, *F. Mueller* ; Port Darwin, *Schultz*, n. 645, 749, 764 (also n. 212, with the foliage of the typical form but the spike 2 to 4 inches long, broad and dense).

Queensland.—Prince of Wales Island, *R. Brown* ; Brisbane River, *Bailey* ; Gracemere, *O'Shanesy*.

New South Wales.—Richmond River, *Mrs. Hodgkinson* ; Darling River, *Dallachy*, *Mrs. Forde*.

South Australia.—Murray River and Cudnaka, *F. Mueller* ; Charlotte Waters, Central Australia, *Giles*.

The only specific localities given by Bailey are the Diamantina and Georgina Rivers. At the same time he quotes Bentham's localities for *S. virginicus* var. *pallidus* as "probably" his species, and adds that probably *S. virginicus* var. *minor*, Bailey, is also to be included in his *S. Benthami*.

Then Prof. Ewart, of Melbourne, remarks :—

Sporobolus Benthami, Bailey = *S. virginicus*, *Kunth*, var. *pallida* (*Gramineæ*). "Queensland Flora," p. 1880, "Bull. Dept. Agric., Queensland," XIII, p. 16.

The twenty-two sheets of this variety in the National Herbarium show a far greater range of variation than Bailey's specimen from the type, and yet have no constant character of more than varietal significance. Although the outer glumes are usually about equal, the lower one is occasionally slightly longer than the upper, and sometimes, especially on the basal spikelets, not more than half its length. In this respect, in the more hyaline outer glumes, and in the longer spike, the variety shows an approach to

S. indicus, R.Br., from which, however, the vegetative habit differs. It is, in fact, possible that cultural experiments might show *S. virginicus* to be a marsh and maritime form of variety of *S. indicus* developed in brackish situations.

Bailey admits that his *S. Benthami*, and his var. *minor* of *S. virginicus* probably form the var. *pallida* of *S. virginicus*, recognised by Bentham, and even a cursory examination of the material at the National Herbarium would have shown that the new species was untenable.—(*Proc. R. S. Vict.*, XX, n. ser., 138.)

Here we have an instance of differences of opinion between botanists as to the amount of variation permissible in a species (*S. virginicus*). There is much to be said on both sides, and while the coastal *virginicus* and the interior *Benthami* undoubtedly run into each other, the typical forms are a good deal unlike. Indeed the whole genus requires revising with the additional material now available. *S. Lindleyi* is "nearly allied to *S. pulchellus*" (Bentham), and yet they are recognised as distinct species, and other species are as closely related.

Value as a fodder.—I believe it to be a useful species for the drier parts of the State.

Habitat.—This species is confined to the drier parts of New South Wales and Queensland. I have referred to specific localities under "Synonyms." In New South Wales it occurs at Lake Cudgellico (J. L. Boorman).

It grows in dense masses in "billabongs" or depressions subject to submersion in rainy seasons (J. H. Maiden and E. Betche in *Proc. Linn. Soc. N.S.W.*, 1906, p. 739).

EXPLANATION OF PLATE.

1. Entire plant, half size.
2. Panicle--branch, much enlarged.
3. A single spikelet.
4. Glumes of the spikelet and fruit.
   - *a*, *b* } Outer glumes.
   - *c* Flowering glume.
   - *d* Palea split in two.
   - *e* Loose pericarp enclosing the grain.
   - *f* Grain removed from the pericarp.
5. Adventitious tufts at the nodes referred to in the description.

[The plate has been drawn from the type specimen supplied by Mr. Bailey.]

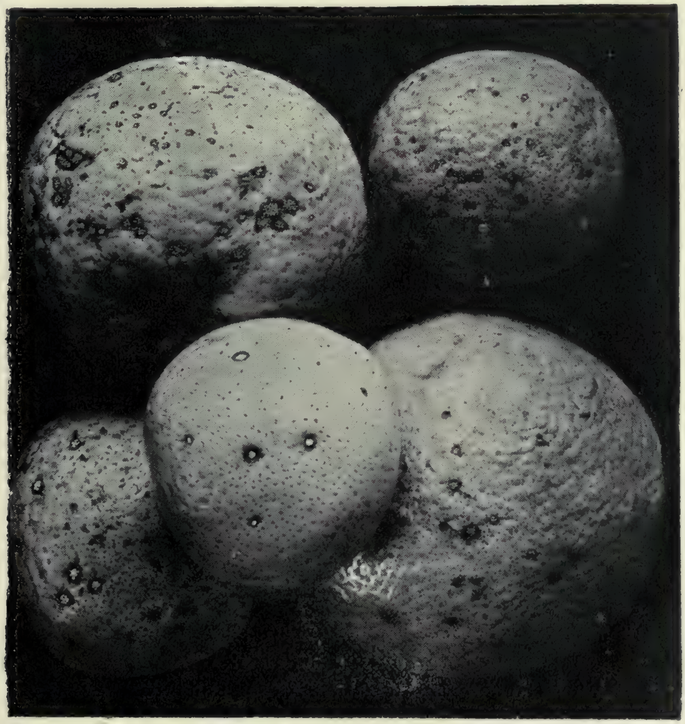
There is a figure (Plate LXXVII of "The Queensland Flora") of *S. Benthami*, though without details.

SPOROBOLUS BENTHAMI, BAILEY.

ORIGINAL, DRAWN FOR THE AGRICULTURAL GAZETTE.

Black Spot in Oranges.

This disease is one that is very prevalent in some of the orange orchards near Sydney. Like melanose, it lowers the market value of the fruit. The appearance of the Black Spot in oranges is well shown in the accompanying illustration. It will be seen that the round sunken spots are large and conspicuous, and seriously mar the appearance of the fruit. The centre part of



Black Spot in Oranges.

each spot becomes greyish or whitish when the fungus causing the disease is mature, at which time several minute dark pustules appear in each spot. These pustules give rise to a multitude of spores (seeds) of the fungus, and as these spores germinate readily when they come in contact with the fruit, the disease spreads very rapidly; thus fruit that was perfectly clean and free from the disease, as far as it was possible to see, during the month of August, or even September, was very badly diseased the latter part of October and through November.*

* A. H. Benson, *Agricultural Gazette*, 1895, page 249.

The disease does not appear to attack the fruit to any extent till it is thoroughly ripe, when it spreads very rapidly, greatly disfiguring the fruit and rendering it more or less unsaleable; in fact, very badly infested fruit falls from the tree and is valueless. The disease spreads very rapidly amongst ripe fruit. As the disease apparently confines its attack to ripe fruit, the treatment that will probably be most efficacious will be spraying the fruit at intervals of ten days or two weeks at the time the fruit is most liable to attack—say from the middle of August to the end of September for the county of Cumberland—with a fungicide which will destroy the spores of the fungus; or, if it does not actually destroy them, prevents their germinating. The best remedy to use for this purpose will probably be ammonia carbonate of copper, prepared as follows:—

Directions for Making Ammonia-carbonate of Copper.

Formula:—	Copper Carbonate	5 oz.
	Ammonia (Liquor Ammoniæ sp. gr. ·880)	3 pints.
	Water	45 gallons.

Make a paste in a wooden bucket of the carbonate of copper and a little water. Add the ammonia, which will dissolve the paste, and then dilute to 45 gallons.

Copper carbonate is obtainable from wholesale chemists, but is not stocked in very large quantities, as there is little demand for it. The price is 1s. 9d. per lb., in 7 lb. lots.

Owing to the difficulty of obtaining carbonate of copper in smaller towns, as well as the high price usually charged for it, the Department recommends that the fruit-growers prepare it.

The following is the method given by Pierce:—

"In a barrel dissolve 6 lb. of copper sulphate in 4 gallons of hot water. In another wooden vessel dissolve 7 lb. of washing soda or sal-soda, in 2 gallons of hot water. The soda should be clear (translucent), and not white and powdery, as it appears when air slaked. When cold pour the soda solution slowly into the copper solution. As soon as bubbles cease to rise fill the barrel with water, stir thoroughly, and allow the mixture to stand over night to settle. The next day syphon off all the clear liquid from the top with a piece of hose, fill the barrel with water, stir thoroughly, and allow it to stand a second night. Syphon off the clear liquid the second day, fill the barrel with water, stir, and syphon off the clear liquid once more the third day. Now pour out the wet sediment from the barrel into a crock or other earthen dish, strain out the excess of water through a cloth, and dry slowly in an oven, stirring occasionally, if necessary, to prevent overheating. Prepared in this manner there should be obtained, if none of the sediment in the barrel be lost, about 2·65 lb. of copper carbonate."

The cost of preparing carbonate of copper by this method will depend on the cost of the sulphate of copper and the sodium carbonate (sal-soda or

washing soda). The present price of copper sulphate is 3d. per lb., and washing soda 2d. per lb.; thus the cost will be as follows:—

	s.	d.
6 lb. of Copper Sulphate, @ 3d.	1	6
7 lb. of Sodium Carbonate, @ 2d.	1	2
	2	8

As these ingredients will make 2·65 lb. of the carbonate of copper, the cost will be approximately 1s. per lb.

The advantages of making it at the orchard are twofold; firstly, the sulphate is obtainable almost anywhere, thus saving delay, and secondly, the cost is less.

Very little time is taken up, as there is no continuous stirring or watching as is the case with some mixtures.

In addition to this spraying of the ripe fruit, it is advisable to give the trees a thorough spraying with Bordeaux mixture as soon as the crop is gathered, as this spray will destroy loose numbers of spots that would remain on the trees till the next season.

The following is the method of making this spray:—

Directions for preparing Bordeaux Mixture.

Formula:—Copper Sulphate (bluestone) ... ... 6 lb.
Lime ... ... 4 lb.

made up with 22 or 45 gallons water, according to the season, the smaller proportion being the winter dressing.

Copper Solution.

It is immaterial whether hot or cold water be used to dissolve the bluestone. If the mixture is to be made in a hurry, it is best to boil the copper sulphate in water. If there is plenty of time use cold water; but in this case the bluestone must be suspended in a porous bag (bit of muslin or sacking) as near the surface of the water as possible. If the copper salt is thrown into the vessel, and water poured on the top of it, it will not dissolve in a week. When suspended as described, it should dissolve in about twenty-four hours.

The sulphate of copper solution when made must be diluted largely before the lime solution is added to it. This is a very important point. If the copper solution is too strong, the precipitate formed is thick and heavy, and liable to clog the nozzle of the spray-pump. If the copper solution is made by dissolving the bluestone in a small quantity of hot water, it should be diluted to 20 gallons before adding the lime.

Lime.

The lime, which should be freshly burnt, is slaked with a small quantity of water. Slaking on a board is to be recommended rather than in a cask, because if the lime is really freshly burnt there will be considerable heat evolved, and the barrel may suffer. Place the whole of the lime on a board, and pour over it 3 or 4 pints of water. The lime, if it is good, should become

very hot, crack asunder, give off a quantity of steam, and finally crumble into a fine white powder. This is now emptied into a barrel and water added. It is not an easy matter to make the whole of the lime into a wash. It cannot be done by simply stirring about with a stick. The best way is to use a shallow tub, so that the lime may be pounded up with the water, all the lumps being broken up. Allow to settle, and pour off the milky solution through a strainer if any lumps are present (into the copper sulphate if you like, or into another barrel), and add more water, repeating the pounding until all the lumps have disappeared.

Mixing.

The mixture must be made by pouring the lime-water into the copper solution, and not by adding the copper solution to the lime-water.

The proportions of the Ingredients.

The proportions above given provide ample lime to more than neutralise all the copper sulphate ; in fact, there is more than twice the quantity required to convert the copper into the hydrate, provided, firstly, that the lime is pure ; secondly, that it is freshly burnt ; and thirdly, that the lime is really all made into wash.

With regard to the latter point, instructions are often disregarded, and in many cases not more than a quarter or half the quantity of lime recommended becomes finally combined with the copper.

If, in addition to this, the lime is not pure, and has been burnt some time before being used, it may quite easily happen that, instead of the above quantities of lime being in excess of what is required, they may be altogether insufficient for the purpose, and that the solution may contain free copper sulphate. Assuming that free copper sulphate, even in small quantities, does "burn" the foliage, and that it is undesirable to have any in the mixture on this account, it appears preferable to have no fixed quantity of lime, but simply to have a definite quantity of copper, and to add the lime until the copper is neutralised. This is the plan recommended in the latest Bulletins of the United States Department, and is described in detail by Dr. Cobb in the *Agricultural Gazette*, April, 1897.

In order to know when the copper sulphate is destroyed, the readiest test is ferrocyanide of potassium ; but it is important to remember that at a certain point ferrocyanide ceases to give the characteristic colouration (in such a solution as we are dealing with), although there is still unaltered copper sulphate in solution. In other words, the solution may contain free sulphate of copper, although the ferrocyanide test, applied as directed, does not show it. Therefore it is important to remember that the mixture is not ready for use when ferrocyanide no longer gives a red colour, but that a quantity more lime (even half as much again) must be added.

Instead of ferrocyanide, a rough test to show when sufficient lime has been added consists in placing a clean knife-blade in the mixture for a few minutes. If there is no red stain on the knife blade, the copper solution is neutralised. When this point is reached, add more lime.

Vessels employed.

For the copper solution, wooden vessels are preferable, though copper vessels may be used. Iron vessels should be avoided. For the lime, wooden tubs or barrels. Do not leave the mixture in the spray-pump, as it will slowly attack the copper; but when the spraying is finished, pour it away and wash the pump and hose well with water.

Purity of Ingredients.

Samples of "bluestone" are often received which contain a quantity of sulphate of iron. This adulteration can only be effected by dissolving copper sulphate and sulphate of iron, mixing the solutions, and allowing them to crystallise out. Such a method is much too elaborate to be carried out on a small scale, and there must be more of the stuff about. The following hints will enable any one to suspect such a compound. Bluestone should be in the form of dark-blue crystals (the adulterated mixture referred to is light-blue, like sulphate of iron). They dissolve completely in water—readily and completely in hot water or water to which any acid is added.

In order to test its purity still further, add ammonia. A pale-blue precipitate is formed, which dissolves to an intense blue colour. This solution should be perfectly clear, and leave no sediment on standing. If a reddish sediment settles, it is due to the presence of iron.

Lime.—The best freshly-burnt stone lime only should be used. To test it, place a few lumps in a small heap and sprinkle with water. The water should be absorbed by the lime, when the latter gradually falls to pieces, becoming very hot in the process, and giving off a quantity of steam. It gradually crumbles to a fine, white powder. If it does not get hot enough to give off steam, it has not been freshly burnt.

The addition of molasses has been found advantageous in the preparation of Bordeaux mixture. Molasses helps the mixture to stick to the foliage, and by its addition saccharate of lime is formed, so that it is easier to get a proper solution which will not choke the nozzles.

If molasses is used the proportion will be—

Bluestone	6 lb.
Lime	4 lb.
Molasses	4 quarts

made up to 22 (for winter) or 40 gallons (for summer) with water.

The Damage done.

The amount of damage done by this disease is variously estimated, but is, on the whole, perhaps exaggerated. According to the observations of Dr. Cobb, it causes much less loss than Melanose, though in some orchards the Black Spot predominate, and in such cases is responsible for much damage.

Further Experiments.

With a view to ascertaining whether the fruit, when picked and packed in a clean or partly affected state, develops the disease in transit by sea or rail, a few cases of citrus fruits were packed in Sydney, and forwarded to Mr. D. McAlpine, the Government Pathologist in Melbourne, who kindly co-operated

in the matter. Of the six cases forwarded three were considered dirty, or the fruit was affected more or less badly with the disease, while the other three were supposed to be clean when despatched; but as a matter of fact they were all more or less affected, with the exception of one case, which contained three oranges perfectly clean.

The results were as follow:—

I. Two cases of oranges from Dural. Received, 19/10/08; examined, 16/11/08.
Dirty case—Saleable 34 oranges.
Unsaleable 24 ,,
therefore, 59 per cent. saleable.
Supposed clean case—Saleable 39 oranges.
Absolutely clean 3 ,,
Unsaleable 3 ,,
therefore, 93 per cent. saleable.

II. Two cases of oranges from Narara. Left Sydney, 4/11/08; received Melbourne, 11/11/08; examined, 16/11/08.
Dirty case—Saleable 32 oranges.
Unsaleable 88 ,,
therefore, 26 per cent. saleable but affected.
Supposed clean case—Every orange more or less affected.
Saleable 86 oranges. Slightly affected; may be only a few spots.
Unsaleable 7 ,, Badly affected.
therefore, 92 per cent. saleable.

III. Two cases of oranges from Dural. Received, 11/11/08; examined, 16/11/08.
Dirty case—Saleable 44 oranges. Not too badly affected.
Unsaleable 65 ,,
therefore, 40 per cent. saleable.
Supposed clean case—Saleable 82 oranges. Slightly affected.
Unsaleable 7 ,, Badly affected.
therefore, 92 per cent. saleable.

The term "saleable" is used when the oranges were not too badly affected with the disease.

In Mr. McAlpine's opinion, the result of this examination shows that, if the oranges are sent from Sydney in a condition supposed to be clean by the grower, over 90 per cent. arrive in Melbourne sufficiently clean to be saleable; and if the fruit is sent absolutely clean—that is to say, without any of the minute indications of the fungus being present—even although no fructifications are present, then they remain clean as far as this disease is concerned.

During Mr. McAlpine's recent visit to Sydney he was taken to inspect several orchards within the zone from which all our diseased fruit come; and he also visited Dubbo, where most of the supplies are drawn from Sydney, and where spotted oranges could be found in the shops at the time of his visit and yet no Black Spot has ever been found in an orchard which is situated in the town, notwithstanding the fact that spot-infested fruits are sold all around.

The result of the experiments show that fruit which had been picked here, and which appeared clean, must have been slightly diseased, although not noticeable at the time; and the conclusion arrived at by the Victorian officer is that fruit which is clean when picked from the tree will not develop Black Spot in transit.

Further investigations are to be made, and the results will be published from time to time.

The Conservation of Soil Moisture.

CHAS. C. NIXON, B.S.A., St. George, Ont. (Canada).

It has been observed at the Ontario Agricultural College that for every day's delay in spring seeding, after the first week had passed in which the seeding should have taken place, there was a great decrease in the yield of grain obtained By actual experiment it was proved that there was an average decrease for each day's delay of 56 lb. of oats, 53 lb. of barley, 29 lb. of spring wheat, and 23 lb. of peas per acre. This was due to the loss of moisture through evaporation.

There are few fields upon which crops of any kind, in any climate, can be brought to maturity, with the maximum yields that the soils are capable of producing, without adopting some means of saving soil moisture. There are fields where, at times, the moisture of the soil is too great, and drainage becomes necessary; but even under these conditions, it will usually be found advisable to adopt measures for conserving the moisture not so removed. Plants must have water in order to live. In most cases, the rains of summer are insufficient to meet their needs. We must rely upon stored-up moisture.

Experiments have shown that, on the average, crops require two and one-fourth times the water that falls during the growing season. It is, therefore, apparent that we must aim to store up water in seasons when no growth is taking place. Some seasons, however, we get too much water and it becomes necessary to make provision for carrying it off. Paradoxical as it may seem, by preparing for a wet season one also prepares for drought. The loosening which favours absorption also favours retention of moisture.

Evaporation is the great source of loss of moisture. Few realise the enormous amount of evaporation that goes on from a given area of soil on a summer day. It has been estimated that from a surface of water 100 x 60 feet, there was an average daily loss from May to October of 20 bbls. At this rate, there would be an average daily loss of 140 bbls. per acre. The amount thus evaporated would, of course, vary with the situation, the exposure and the temperature. No definite data, to show how the evaporation from soil would compare with that from water, has ever been compiled. It is believed, however, that where soil is bare, and it appears moist on top, the evaporation would be equal, or possibly greater.

To conserve soil moisture, then, is the great problem with which we have to do as farmers. The great agency employed for this important work is some system of mulching. Many kinds of mulches are available. The one most generally used is the earth mulch. It is simply a loose blanket of earth which dries out, preventing the water below from passing up through

it to the atmosphere. The effectiveness of a simple earth mulch in conserving moisture is beyond the comprehension of the average tiller of the soil. Experiments have proven that a mulch 3 inches deep prevented a loss of 36 per cent. of the moisture lost where no mulch was used. The average saving by means of mulches ranges from 25 to 50 per cent., varying with the depth of the mulch. To be the most effective, these mulches must be formed as soon as the soil is fit to work in the spring, as well as after every rain in summer, if the crop will permit. A delay of one week in spring, or after a heavy rain, will result in a loss of moisture by evaporation equal to one and three-fourths inches of rain, or enough to tide a crop over two weeks of drought. From this data, the advantage of seeding at the earliest possible hour is apparent.

The first effect of mulching is greater evaporation, due to the larger surface of wet soil exposed. This loss, however, is from the stirred soil only. Very little water can pass through a mulch after it becomes dry. Should the mulch settle back and appear moist, a second stirring will be necessary. Mulches should not be made too deeply. They are made of the best soil, and when this is dry it is of no use for plant feeding. Mulches should be made as thin as is possible without permitting too heavy waste of the deeper soil water. The depth of mulches must vary with the seasons and with the crops.

Spring seeding is closely connected with this great problem of conserving soil moistures. Early seeding enables crops to use the water otherwise lost by evaporation. It may also save plant food from leaching in the drainage waters by having made use of this water in the plant economy. There is danger in too great haste in seeding, however. One might better be a little too late than too early. If too early, the plants come weak and sickly or the seed rots in the soil. The effectiveness of tillage in conserving soil moisture is greater in the spring than at almost any other time. In the spring, there is invariably a wet surface exposed, and this wet surface carries water off much more rapidly than can dry soil. Too frequent stirring of the soil is undesirable. One should aim to keep simply a dry, loose blanket of soil, which will make the effective mulch. It frequently happens that, owing to the area to be covered, it is not possible to work it all as early as would give the best results. In such cases, where one has not time to form a thorough mulch, a single cut of the disc, or even of the spiked tooth harrow, will work wonders in conserving soil moisture.

All mulches need not be made from soil. Some of the best and the most effective are made from manure. By applying barnyard manure as a top-dressing one obtains a physical, as well as a chemical benefit from it. The seasons' rains wash the fertilising constituents into the soil, where they will be available to the plants. The refuse remaining on top makes an effective mulch for retarding evaporation. This double action of manure, when applied as a top-dressing, is a strong argument for pursuing this practice and for making use of the manure-spreader, in order that the manure may be more advantageously applied.

The problem of soil moisture is intimately involved in the method of cultivation practised for root crops. With flat cultivation, less surface is exposed to the action of the atmosphere; hence there is less evaporation and consequently larger crops. It is well known to all that root crops, when grown on ridges in seasons of drought, have small chance of succeeding. This accounts for the growing popularity of the level system of culture.

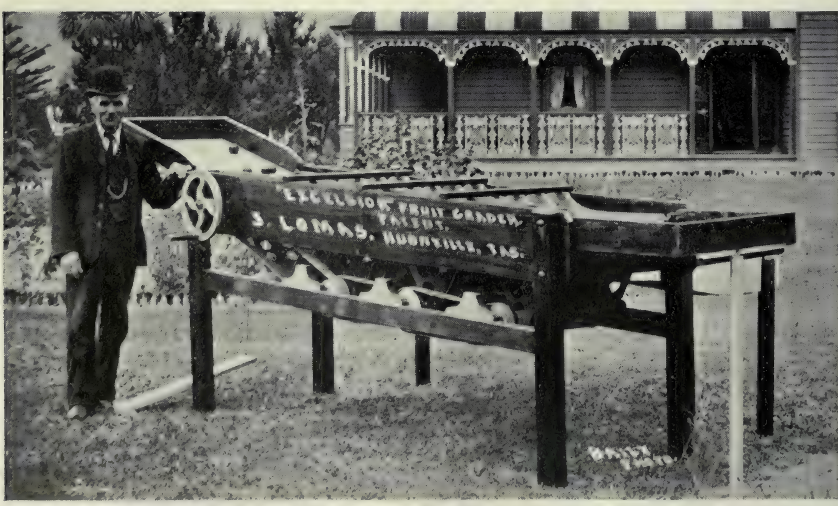
Under-drainage is also a large factor in conserving soil moisture. It is a matter of common experience that crops on well-drained soils will withstand drought better than those on similar soils not so well drained, although the crops at the commencement of the drought were equally good. The explanation of this phenomenon is, that drainage always improves the texture of the soil. With this improved texture comes increased capacity for retaining water.

Windbreaks and hedges are highly beneficial in conserving soil moisture. Especially is this true in times of high wind, and particularly in connection with lighter soils. The clearing of forest areas and the diminishing size of our wood lots is involved in this question. The winds attain a greater velocity than ever, and a consequent greater loss of soil moisture is the result. Windbreaks and hedges, by holding the snow in winter, also add greatly to the moisture content of the soil through the melting of the snow in spring.

When we realise the full force of the tremendous loss of soil moisture through the agency of evaporation, we will look to it in future that this loss is held in check by the timely use of the simple, yet effective, means at our disposal.

To Destroy Mound Ants.

In the evening, when all the ants are in the nests, pour a large tablespoonful of bisulphide of carbon down half-a-dozen of the main openings. Then throw a wet bag over the nest and let it remain for two or three minutes. Take off the bag and apply a lighted match, fastened to the end of a stick, to each treated opening, when the ascending fumes will ignite and explode, shattering the nest and killing the ants within it. By this means not only are the ants killed but the nest is destroyed. No danger need be feared in igniting the fumes in the nest, but care must be taken, when placing the bisulphide in the nest, not to have a light about, as the chemical is very inflammable.



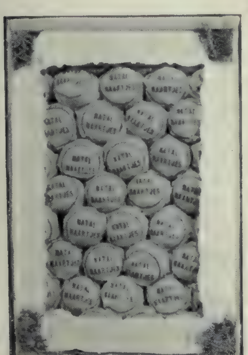
The "Excelsior" Fruit Grader.

A New Fruit-Grader.

WE are indebted to Mr. H. E. Pittman, of Southbridge, Huonville, Tasmania, for the following description and cuts of Mr. Lomas' new fruit-grader. It will be of interest to many growers, as it was considered by the Tasmanian apple-grower to be the best in the market at the present time. It is well-known how difficult it is to get a grader that will do good work without bruising or damaging the fruit, and any machine which will grade all fruit properly at one operation is infinitely superior to a machine through which the fruit has to pass twice to do the same work, as there is always more or less risk of bruising at each operation, which is precisely what we most wish to avoid—in fact, which must be avoided if we hope to do well out of any apples we export.

NATAL MANDARINS.

NATAL is working up an export trade in mandarins, or "naartjes" as they are locally termed. Great attention is paid to the wrapping and packing,

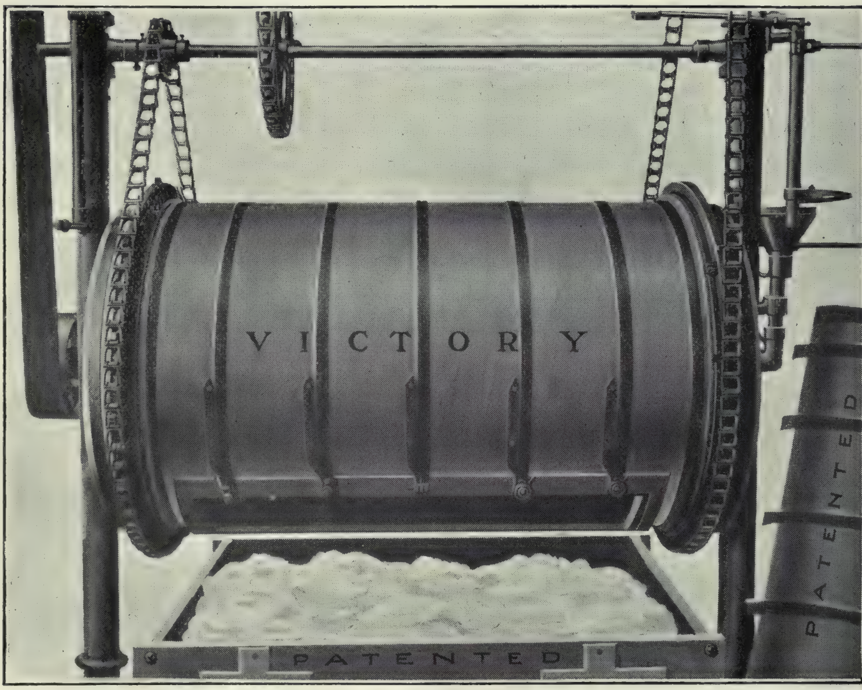


and our illustrations show the attractive manner in which the fruit is prepared for export. The wrappers are 7 inches x 6 inches, "Natal Naartjes," being lettered in gilt, in a circle, in the centre of which is a crest, also in gilt.

The Combined Churn and Butter Worker.

M. A. O'CALLAGHAN, Chief Dairy Expert.

THIS machine, though representing an old patent, is, practically speaking, new to New South Wales, and at the present time is on its trial at some of our best factories. An almost identical machine had been used in margarine factories some years ago, but it was in the United States of America that it



The Victory Churn and Butter Worker.

As manufactured in Australia. The position shown is after the self-delivery of the butter.

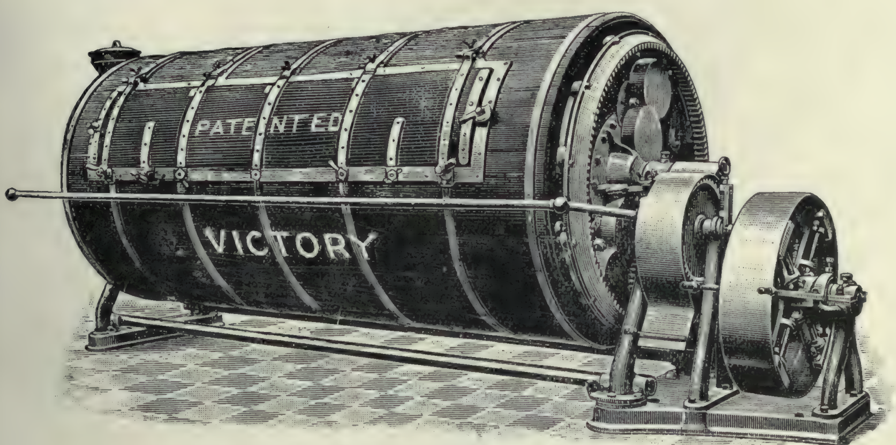
was first utilised for butter-making. The Danes also took the machine up, and made what may be considered by some an improved pattern thereof. At any rate there are three brands of this machine, that are nearly identical in type, being used to a considerable extent in Danish butter factories at the present time.

During the recent session held by the Department of Agriculture for factory managers and butter-makers, the churn was put on its trial at the Berry Central Butter Factory, and the opinions of those present, even among the instructional staff, differed somewhat, especially at first.

My conclusion, however, was, that with an operator who understood the art of butter-making thoroughly, and also understood the necessaries which enabled this machine to do its best work, a butter could be turned out equal to that made by the present general machinery, namely, a separate churn and butter worker.

From an economical point of view, this combined churn is of interest, and it is well worthy of the consideration of those who contemplate the erection of butter factories.

The fact that the butter is salted and the making completed in one operation, does away with the necessity of having a separate room in which to give the butter its second working, as is done in our best factories to-day. It also does away with the necessity of having a cool room in which to store the said butter while waiting for its second working. This would mean that we could erect factories with at least one room less, and, in some cases, possibly two, and do the same amount of work as at present.



The Victory Churn and Butter Worker.
As manufactured in Denmark.

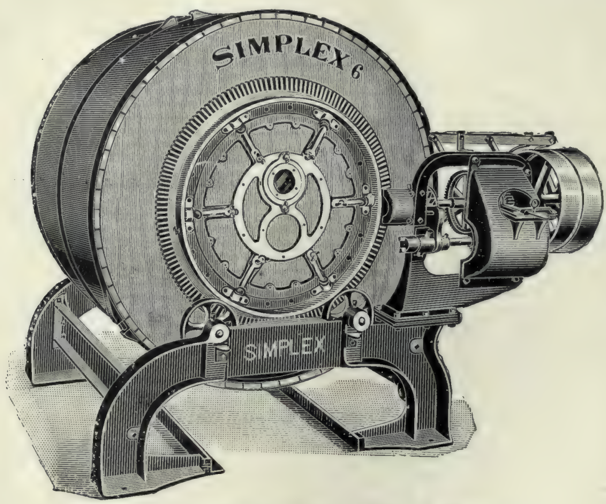
It has another advantage, namely, that the machine does not grow tired. We all know, and have experienced, how tired a human butter worker is towards the end of a long summer's day, and we know that his manipulation of the butter on the working table is not then nearly as good as when his efforts were fresh, and, as a consequence, the texture of the butter made at the end of the day will not always be as good as that made in the morning.

Streaky Butter.—Probably the commonest fault in Australian butter manufacture is that of streakiness. As has been often pointed out, this is due to an imperfect mixing of the salt with the butter, and should not be confounded with what is known as mottled butter, which latter is due to the presence of casein in the butter in a condition which prevents its being thoroughly intermixed with the butter fat.

Now, with the combined churn and butter worker, although the working is completed in one operation, I do not see any reason for the presence of streaky butter.

Streakiness is caused, as a general rule, through the salt not dissolving properly in the water contained in the butter, and this is due to many causes, but chiefly to the fact that many butter-makers work the butter partly dry before they add the salt, the result being that sufficient water is not present to quickly dissolve the salt, and unless the butter is worked a second time streakiness becomes almost a certainty.

With the combined churn and butter worker, salt is added to the churn before the water becomes thoroughly drained off; the consequence is that extra salt has to be added, but there is an abundance of water present to



The American Simplex Churn and Butter Worker.
As used at Berry Factory during the recent Dairy School Session.

dissolve it rapidly, and hence the machine mixes it with the butter more readily, and avoids the probability of streakiness. Also, it is not nearly so easy to overwork butter in the combined worker as by the ordinary process, because the friction on the wood is considerably less, and there is no slipping of the butter, which tends to greasiness.

These are the points that go towards advancing the claims of this combined machine; but one main thing should be considered wherever it is proposed to erect them, namely, that the temperature of the room in which they are placed shall be under control, otherwise it will be impossible for the machine to do its work properly, and an excessive amount of moisture will remain in the butter and, also, owing to the high temperatures prevailing, greasy butter will become probable, as well as butter containing too much casein and milk sugar.

The Prickly-pear.

Its Utilisation.

E. HARRIS, Department of Agriculture.

It is a startling reversal of the popular impression in New South Wales of the prickly-pear as a dangerous pest, to learn that in other countries, where somewhat similar conditions as to climate and soil prevail, prickly-pear is considered a valuable fodder plant, and cultivated as such. In Australia, rewards have been offered for its eradication. In New South Wales, where thousands of acres are rendered useless, a special tenure of the infested land is given if only the occupier will rid the soil of its unwelcome crop. Periodically the Press, both lay and scientific, publish alarmist articles of the spread of the pest, and many recommendations are made of methods for its destruction and eradication, in some cases estimated to cost much more than the capital value of the land. The matter has even engaged the attention of the great Burbank, who, after many years experimenting, evolved a spineless pear, which is said to possess considerable value as a fodder, but which, unfortunately, is also reported to have reverted to its original "spiny" condition.

All efforts at eradication at reasonable cost having failed, it is a matter for serious consideration whether further experiments with prickly-pear should not be in the direction of rendering it of some value as a fodder plant, and in this connection it is of interest to learn what has been done in other countries.

The United States.

The Feeding Value.—The cactus problem is one to which the experts of the United States Department of Agriculture have devoted much attention. In Bulletin No. 102 of the United States Bureau of Plant Industry, an attempt is made to determine in what proportion cactus should be fed with other foods to produce a balanced ration. For this purpose, it is necessary to know the amount of digestible nutriments contained in the cactus, as well as those of the food or foods with which it is to be fed. This has been determined for most foods, but, unfortunately, there are as yet no such data for the cacti. By assuming, however, that this digestibility coefficient is the same as that of immature green mealie fodder, the authors find the nutriments in *Opuntia Lindheimeri* to be: Protein, 0·47 per cent.; fat, 0·26 per cent.; carbohydrates, 7·85 per cent. This being the case, it is added that cactus would have a nutritive ratio of 1:18, a ratio which, according to the best authorities, would prohibit its use alone for any feeding standard. The nutritive ratio for a standard ration, it is pointed out, varies from 1:4 to 1:12, depending upon the age, character, and kind of animal to be fed, as well as the object of the feeding; that is, whether it is desired to produce work, flesh, or milk.

If the object of the feeding is to produce milk, a cow giving a heavy yield of milk should, according to the best authorities, be fed about 25 to 30 lb. a day of organic matter, containing from 1·8 to 2 lb. of digestible protein; from 0·4 to 0·7 lb. of digestible fat; and 11 to 13 lb. of digestible carbo-hydrates; making a nutritive ration of from about 1:5·5 to 1:7. If a cow requiring a ration of this kind should eat cactus alone, it would take 160 lb. to furnish the fats and carbo-hydrates, and an additional 240 lb. to furnish sufficient protein; and since, to avoid scouring, a cow should probably not be fed to exceed 50 or 60 lb. of cactus a day, it may be readily seen how impossible it would be for a milk cow to get even a one-sided ration from cactus alone. A ration of 40 lb. of cactus, with 10 lb. of wheat bran and 12 lb. of mealie stover would, it is stated, furnish the nutriments in somewhat near the proper proportion. In a ration of this kind, the cow would get 21·6 lb. of organic matter, containing 1·68 lb. of protein, 11·82 lb. of carbo-hydrates, and 0·49 lb. of fat, which is in a ratio of 1:7·7.

Feeding to Stock.—Practically, all the Mexican prickly-pears are fed to stock to a greater or less extent, especially those growing where the fodder is the most scarce, but there is only one cylindrical-jointed species (*Opuntia imbricata*) which is used to any appreciable extent. The authors state that their experience has shown that *Cereus giganteus* is readily eaten by cattle when chopped up, but add that they know of no feeding having been conducted with it on any commercial scale. *Echinocactus orcuttii*, which is typical of a considerable group of species, is occasionally fed in Lower California. It is only in rare instances, however, that any great quantity of feed can be secured from cacti, outside of the genus *Opuntia*, and the greater part of the feed in this genus is stated to be produced by the flat-jointed forms. There are about five species in the cylindrical-jointed group which have been fed with some success: *O. imbricata*, *O. arborescens*, *O. spinosior*, *O. fulgida*, and *O. prolifera*. These species constitute the best of the cylindrical-jointed group; and of these, *O. fulgida* and *O. imbricata* are said to be, probably, the most valuable.

Mexico.

Human Food.—In the course of another Bulletin, issued from the Agricultural Experiment Station, New Mexico, some particulars are given of the use of the prickly-pear in Mexico. In that country, the use of the prickly-pear is much more varied than in the United States. All the species are fed to stock indiscriminately. Whatever is available and can be spared is singed and fed to cattle. The extent of cattle-feeding upon this kind of food is not, however, so great in Mexico as one would suppose from the abundance of the material and the great extent of time during which the practice has been in vogue. The fact is, it is stated, that the average peon cannot afford to feed to stock what he himself can use so profitably in other ways. The prickly-pear is to the peon, primarily, an article of human food, and its place cannot be taken by any other plant. The fruit, as well as the young joints, are eaten by man in Mexico, and the dried stems and joints are used for fuel. The fuel which it makes is, of course, exceedingly poor, but it serves the purpose

in that land, where this commodity is exceedingly scarce. The feeding of cacti to stock is, therefore, a secondary consideration. On some of the large haciendas, especially those devoted to maguey culture, the feeding of pear to working oxen during the grassless season is a regular practice, but then only wild forms are used. Over a large part of the Republic, therefore, although a large use is made of them for forage, their principal use is as an article of human food.

Texas.

The latest information from the United States is contained in a paper read before the Second Session of the Trans-Missouri Dry Farming Congress, held in Salt Lake City, Utah, in which it is pointed out that the vigorous prosecution of the prickly-pear question was not begun by the Department of Agriculture until about four years ago. Since that time investigations have been organised in several of the south-western States; but the major portion of the work up to date has been conducted in the pear region at San Antonio, Texas. What follows, therefore, will relate to those experiments, and has application to that stretch of territory extending from the Gulf to Del Rio, and from Austin to Brownsville, comprising 50,000 to 75,000 square miles. The application to other regions was not made, as it would be necessary, first, to secure more data on these regions before we can speak positively of the value of this crop in other sections.

The people of Texas have known for fifty years how to utilise the native crop of prickly-pear, which is very prolific in many sections; but it was necessary, when the investigations were begun, to determine, first, the value of the plant as food for stock from a scientific standpoint by chemical and digestion tests, as well as by actual feeding under controlled conditions; second, it was most essential to determine the rate of growth of the plant, both under natural conditions and under cultivation.

The Value for Stock.—The first investigations were conducted with a native crop three years ago. A carload of steers were fed under controlled conditions for the Department by Mr. T. A. Coleman at Encinal. Without going into the details, let it suffice for it to be said that prickly-pear was fed as a roughage (as it should always be fed) with cotton-seed meal. The experiment justified such practices by ranchers of the section, inasmuch as the increase in weight of animals cost only $3\frac{1}{2}$ cents ($1\frac{3}{4}$d.) per lb.

In a similar experiment at San Antonio with milk cows, prickly-pear as a roughage was alternated with sorghum hay in conjunction with a constant concentrate ration, consisting of cotton-seed meal and rice bran. Here it was found that all the cows would eat of prickly-pear produced a little better results than all they would eat of sorghum hay. Here $1\frac{1}{3}$ lb. of butter, it is stated, was made at a cost of $13\frac{1}{2}$ cents ($6\frac{3}{4}$d.) per day.

The experiments show conclusively that the prickly-pear can be used in that region profitably in beef and butter production.

Preparing for Food.—In the early history of pear-feeding, which dates back to the Civil War, the plants were prepared for food by being singed with brush. This practice is still in vogue with many small ranchers, and

the same custom prevails among the few people who feed cane cactus in south-eastern Colorado. Early in the 80's a machine was invented by a Dr. Carruthers for chopping the pear so that it could be fed without injury. The original machine has subsequently been improved, so that it is claimed now by the manufacturers, and also by the feeders, that eight men and four teams, with pear handy, can feed 1,500 head of cattle. The most useful pear machine, however, is the gasoline torch, which is a modified plumber's torch. By the use of this instrument one man can feed 400 cattle without difficulty. This is used simply to singe off the thorns, which burn very readily. The plants are singed where they grow, and the cattle are then turned on to graze on them without further preparation or handling.

Cultivating the Pear.—The next line of investigation demanded appeared to be upon the rate of growth of the plant. A peculiar condition exists in portions of Southern Texas. Prickly-pear originally grew abundantly in the vicinity of San Antonio and some of the other larger towns, but now there is, practically, none of it to be found. Dairymen have all but exterminated the plant in their search for winter succulence. It is in the vicinity of these towns that the demand exists now for such a food. Experiments were, therefore, started in San Antonio.

Three years' growth was secured upon the experimental plantation at San Antonio. This is the first instance, in that country at least, where this plant has been grown under field conditions. The practice had been to thoroughly prepare the ground and lay it off in 6-foot rows. Stock for planting was secured from the surrounding pastures. The plants are cut up into single joints, and these joints, handled with a fork, are distributed about 2 feet apart in the rows. The cuttings are really not planted at all—they are simply laid upon the ground. They make really better plants in this way than when planted on edge. This method of planting can be pursued at any time of the year when the ground is moist. It is not prudent to plant in July or August, but at any other season the plants will grow readily. When the ground is dry, however, it is best to lay the field out in rows with a plough and partially cover the cutting in the furrow. This can be done by another furrow or by the use of a sulky cultivator.

The yield of prickly-pear per acre is, it is stated, of course, fundamental in all of these investigations. Its value depends upon the quantity of feed which it will produce under existing conditions. Thus far, three years' growth was secured. One of these seasons was very dry, the other exceptionally wet, and the second about an average season. It was estimated, therefore, that the average growth for these three years will probably represent, quite closely, the average for a longer period. It was believed that it will be most advantageous to harvest this crop not more often than on alternate years. However, it will do no harm to allow the crop to stand three or four years longer before harvesting it. It will produce a large enough crop, however, to be harvested at eighteen to twenty-four months after planting. During the past three years an average annual growth of 23 tons per acre was secured. In the experiments mentioned above, conducted at Encinal, it was

found that steers being fed for the market consumed about 75 lb. of pear per day. The milk cows at San Antonio consumed about 140 lb. The average consumption would, therefore, probably be in the neighbourhood of 100 lb. These figures, taken in connection with the yield which was secured during the past three years, would indicate that roughage for about $1\frac{1}{4}$ cow can be grown upon 1 acre of ground. In order to be conservative, suppose it was estimated at one cow per acre, which seems from the returns to be perfectly safe. Even this is better than is done with hay in the majority of the strictly agricultural sections of the United States, and this crop, it must be remembered, was grown under conditions where sorghum produced from 1 to $2\frac{1}{2}$ tons of silage per acre per annum.

In conclusion, it is stated that the crop is easily handled, is drought-resistant and yields heavily, and it does not seem clear how it can fail to become an important adjunct of the beef and butter production of Southern Texas.

Europe.

In at least one country in Europe—Sicily—the prickly-pear is valued as a food for both man and beast. M. de Gasparin, the celebrated agriculturist, wrote on his return from a voyage to Sicily :—

The Manna of Sicily.—Prickly-pear is the manna, the providence, of Sicily. Those who have not seen the abundance of its production, and the almost universal use which the inhabitants make of it from July to November, would consider these epithets exaggerated ; but when one knows all that the island owes to the plant, one can only praise it. We may begin by saying that the peasants are fed entirely on these fruits from the moment at which they come to maturity, for as long as they remain on the plant ; they consume twenty-five or thirty of them each day. Sicily fattens during these four months ; when this is past fasting begins.

Composition of the Fruit.—At the outset, it seems not unreasonable to conclude that what will nourish man will also nourish beasts. The particulars contained in Wolff's tables confirm this opinion. The fruits have the following composition :—

Dry substance	21·60	per cent.
Ligneous matter	3·70	,,
Proteid substances	0·59	,,
Fatty bodies	1·80	,,
Sugar	14·00	,,

Upon these data Wolff assigns to the fruit the number 304 as the "comparative nutritive number"—that is to say, to equal 100 kilos of good dry hay, taken as a forage type, we require 304 kilos of the fruits of the prickly-pear.

The figures given by Wolff for the following roots, fleshy fruits, &c., are as follow :—

Potatoes	241	Fodder beet-root ...	484
Jerusalem artichokes	290	Radishes	704
Carrots	434	Pumpkins	723

The fruits of the prickly-pear, therefore, hold high rank in this scale, coming a little after potatoes and Jerusalem artichokes, far before carrots and beet-root, and much before radishes and pumpkins.

New South Wales.

Several instances are reported of the prickly-pear having been utilised in this country for feeding stock, and, in view of the results, it is remarkable that further investigations on these lines have not been carried out.

Feeding Pigs at Minto.—In 1895, Mr. J. F. Gorus, of Eschol Park, Minto, having occasion to get rid of a quantity of prickly-pear growing on the estate, determined to test the value of this plant boiled with meat and refuse for pigs, and took careful notes of the results. The plants were chipped down with a hoe, pitchforked into a dray, and conveyed to the boiling down. This consisted of a series of ordinary iron tanks (400 gallons) set in brickwork, the lid cut out and placed at the bottom so as to form a double bottom over a fireplace, 2 feet 6 inches square, the object of the large fireplace being to enable whole logs to be used for fuel, and so reduce cost of cutting, &c. At the time the experiment with prickly-pear was carried out Mr. Gorus was boiling down a large quantity of sheep for tallow, and when the fat had been skimmed off, the plants were pitchforked into the soup in the boilers. They were then boiled for some hours, until the leaves began to peel, when it was found that the large hard thorns became quite soft, and the little bristles, which are so irritating to the tongue, were also rendered soft and harmless.

The contents of the boiler were then allowed to cool, and conveyed to the piggery, where the "soup" was run off into a trough, and the leaves and stalks of the prickly-pear thrown to the pigs. The effect of the addition of the plant to the soup was to render it of almost jelly-like consistency. The pigs devoured it greedily, and evinced a great liking for the boiled plants, chewing up the succulent leaves and stalks, and spitting forth the fibre perfectly macerated. A large number of pigs, nearly 200, were fed in this way for several months, and not one of them showed the least sign of internal trouble from the thorns or bristles.

Sometimes the plants were merely boiled in water, and fed to the pigs, with the addition of just a small quantity of molasses. When treated in this way the pigs showed a greater liking for the stalks, which appeared to be extremely succulent, and the source of considerable nutriment.

Of course, it was not to be expected that the cooked plant of itself would fatten the pigs, but Mr. Gorus, from his experience, had no hesitation in placing the feeding value of this plant higher than that of melons or squashes. The experiment was carried out in a very dry season, when there was very little grass or other green feed available. The boiled plants proved, so far as the health of the animals was concerned, an invaluable substitute for the green feed necessary to maintain meat-fed pigs in perfect condition. The expense was simply the cutting down and carting of the plants; boiling was a mere trifle, and there was, of course, in addition to the feeding value of the plants, the advantage of absolutely ridding a large area of land of this troublesome pest.

When the difficulty of totally destroying the prickly-pear is taken into consideration, the following suggestion by Mr. Gorus might commend itself to anyone striving to rid his land of this formidable weed. Mr. Gorus suggests that instead of throwing the plants into heaps and waiting months for them to become sufficiently dry to burn readily, an old 400-gallon tank should be procured, and the fuel that is now used for burning the plants could be utilised for boiling them. If there were no animals that might eat the cooked plants, they could simply be tipped out and allowed to rot. Anybody who has tried to burn off prickly-pears will understand how great is the quantity of wood required, and how readily an imperfectly burnt plant will start into growth.

Feeding Dairy Stock at Lochinvar.—Mr. W. L. Boyce, of Lochinvar, in 1897, related his experiences and experiments with prickly-pears:—On the 5th January, 1895, a flood in the Hunter River destroyed all the standing crops in the district, and this being immediately followed by a drought, prevented the growth of barley and all other winter crops. The winter of 1895, therefore, proved a very severe one, many cattle dying. The first of his cattle went down while there was plenty of dry grass, and the stock in fair condition; the cause of death being, it was believed, inflammation of the bowels. Having no green stuff to give the poor brutes, he conceived the idea of boiling prickly-pears, of which he had a fair supply, but not sufficient to feed all the stock right through the winter. With the dry grass the cattle became bound and tucked up like greyhounds. For the first two or three days the pears acted as a purgative, after that they kept the bowels nicely open; in a few days the bellies commenced to drop, and in from a week to a fortnight the animals looked round and full again, ready to be turned out in the back paddock. He fed the milkers for about four months.

To start the cows with the new food he added bran and salt, though he thought this was hardly necessary, as it will generally be found that one beast in a mob is ready to taste anything new, and the others soon follow. The cattle become so fond of the pears that they would, in their impatience, pick them up so hot that they would have to drop them again. The cows improved in condition, and their milk was good; one, in particular, who got more than her share, fattened on the pears. A large-framed cow, that was very weak after calving, and could barely walk, recovered on this feed, and continued to milk for twelve months after.

Pigs also did well on the boiled pears alone. Mr. Boyce's neighbour saved his pigs by giving them a quantity of the wash from his pot every day. The balance of this wash or juice he poured into a trough for the cows, which drank it readily, although a good lagoon was alongside of them.

For a boiler he used a 200-gallon square iron tank, with a 17-inch man-hole. This was set in a trench in a sloping bank, with a fireplace 3 feet wide by 18 inches deep underneath, and a flue 2 feet wide by 6 inches up the back this gave a good draught, and the tank being half buried retained the heat.

About 9 inches of water in the boiler is sufficient. Fill up with pears—leaves, stalks, and all—in bunches as large as you like, and put on the lid

as nearly steam-tight as you can get it. Make a quick, fierce fire, and the steam will cook the pears right to the top beautifully. The pears will soon settle down in the boiler, when more can be added.

He filled the boiler and fire up in the evening, and next morning found everything just right.

If it is desired to make two feeds of the one boiling, replace the lid, and the contents will keep warm for two days.

When cooked, the leaves retain their shape, and are easily removed from the tank with an ordinary pitchfork, and can be thrown on the grass for the cattle.

Boiling or steaming renders the thorns and prickles soft and harmless.

Lest some may be tempted to cut the top off the tank, he adds that he had tried it, and found that it is necessary to confine the steam, or else cover the pears with boiling water, which means that much more fuel will be required. It appeared to him that the boiler above described is the handiest and cheapest thing for the purpose.

He found that after steam was up any pears added would cook in thirty minutes, and estimated that where pears are plentiful, and fuel and water handy, one man, with two or more pots, could feed 200 head of cattle.

Feeding Cows at Singleton.—Mr. J. O'Shea, of Singleton, reported that in 1897 dairymen were feeding the prickly-pear in a boiled state to cows, either pure, or, better, mixing a little bran with them, and the cattle were not only living, but giving a very fair share of milk. The pears also made an excellent mess for pigs, and were keeping alive all the pigs in the district.

Prickly-pear Silage.—Later on, Mr. Boyce, of Lochinvar, again reported to the Department, this time to the effect that he had included twenty loads of prickly-pears in a stack of silage with maize and sorghum. The experiment was an unqualified success, and the cattle liked the pears quite as well as the other constituents of the silage, preferring them in that form to the steamed pears.

The silage was made in a stack in the open, and pressed with home-made mechanical appliances, and covered with iron. Owing to the drought the stack was only a small one. The base of the stack was 19 ft. x 16 feet 6 in., and only 3 feet high in its compressed state. He estimated that the pears amounted to one-third of the whole stack. In building the stack he put alternate layers of pears and maize and sorghum, four loads of pears in one layer, but never allowed the pears to be nearer than a foot to the edge.

He fed his cows on this silage, steamed pears, and barley, all on the same day; there was also a good picking of green herbage, yet everything was eaten up clean. The milk test was 4 per cent. of butter-fat, which was amongst the highest at his creamery.

Now, as this ration has a good proportion of prickly-pear, the facts stated prove that there is considerable virtue in the much-despised prickly-pear.

It only remains to add that the pears were placed in the stack whole, including thorns and roots, the largest bunches being afterwards chopped to flatten them.

The heat and ferment of the silo softened the thorns and rendered them harmless.

He always added a bag or more of coarse salt to a stack to make the fodder more palatable.

Analyses.

The following are analyses of the fresh leaves of prickly-pear made by the Departmental Chemist :—

	Water.	Ash.	Fibre.	Oil.	Albuminoids.	Carbo-hydrates.	Nutrient value.	Albuminoid ratio.
1. Opuntia ficus Indica ..	93·76	1·22	0·55	0·35	0·50	3·62	5	1 to 9
2. Opuntia elatior	89·76	1·92	1·39	0·35	0·65	5·93	$7\frac{1}{2}$	1 to 9
3. Opuntia Brasiliensis ...	86·19	2·43	1·51	0·46	0·90	8·51	$10\frac{1}{2}$	1 to 10
4. Opuntia coccinellifera ...	87·89	1·73	0·96	0·34	0·78	8·30	10	1 to 12

The average composition of prickly-pear, as determined by the above analyses, is not dissimilar to that of turnips, an analysis of which vegetable, by Professor Church, is appended for the sake of comparison :—

Composition of White Turnips :—

Water	92·8
Albuminoids	0·5
Carbo-hydrates	4·0
Oil	0·1
Fibre	1·8
Ash	0·8
	100
Nutrient value	4

Albuminoid ratio, 1 to 6.

Further Investigations.

The experience in Texas and Mexico would lead one to hope that the most promising method of dealing with the pest may be to utilise it as a fodder, and with a view to ascertaining whether such a course could be profitably followed, it is the intention of the Department to carry out a series of experiments.

Other Commercial Uses.

Last year the Press announced that a Brisbane chemist had discovered in the prickly-pear commercial possibilities quite alluring, and calculated rather to encourage its cultivation than its destruction. Spirits, feed cake, strawboard, and sugar were a few of the marketable products to be obtained from the pear, and with a view to encouraging such a laudable effort to utilise one of Australia's worst pests, communication was entered into by this Department with the Queensland Department of Agriculture. The Brisbane chemist was, however, unknown to the Department, and the Postal Department also failed to locate him. However, within the last few days the writer

has had submitted to him a small quantity of spirits, which, it is stated, was distilled from prickly-pear by a Sydney resident, and at the time of writing, the process of distillation from a quantity of pear is being demonstrated at the Departmental Laboratory. Should it eventually prove that alcohol can be distilled at a small cost, it is certain that a big step shall have been taken towards the solving of the prickly-pear question.

In Germany, France, and the United States, great use is made of commercial or denatured alcohol for power, heat, and light. In Germany, the inland revenue laws have been so modified to allow a German farmer to produce his own alcohol for commercial purposes without any internal revenue tax, and the consumption is increasing at the rate of about 20,000,000 gallons per year. In France the annual increase is about 1,000,000 gallons per year. The United States, some eighteen months ago, enacted legislation allowing of the manufacture of alcohol for industrial purposes free of an internal revenue tax, provided it was denatured, that is, made unfit for human consumption, and large quantities are now used for lighting, heating, and for power in gasoline engines.

In Europe alcohol is derived principally from the potato and the sugar beet. An average acre of potatoes would produce about 250 gallons of alcohol, but special varieties are being grown which produce 500 gallons per acre, while in the United States 50 bushels of corn would make 140 gallons of commercial alcohol.

For lighting, alcohol is burned in a mantle. A recent test gave 30·35 candle-power for 57 hours 5 minutes from 1 gallon of alcohol. One gallon of coal oil gave 30·8 candle-power for 28 hours 40 minutes, showing that 1 gallon of alcohol gives nearly as much light as coal oil and the light is superior. An advantage is that it is non-explosive, and can readily be extinguished with water. For heating it can be burned in gas or gasoline stoves. In America the cost is stated as high as 1s. 3d. and as low as 4½d. per gallon.

Feeding Calves on Whey.

Complaints have been made by several dairy farmers on the South Coast, who supply their milk to cheese factories, of the poor results they obtain from feeding whey to calves and pigs. They contend that much better results are obtained from separated milk. On inquiry having been made by an officer of the Dairy Branch, it was ascertained that on the farms from which the complaints emanated, the calves were fed all together from one big trough, some getting too much and others not enough, while the times of feeding were not at all regular. To obtain good results from feeding with whey, the calves should be fed at regular times, and each calf should be fed separately with a measured portion. Cleanliness should be observed, and all feeding utensils washed every day. Numbers of calves are killed annually through inattention to small matters connected with the method of feeding.

Note on the Milling nature of the New South Wales Harvest of 1908-09.

F. B. GUTHRIE.

THE F.A.Q. wheat standard for the 1908–09 harvest was fixed by the Grain Trade Section of the Chamber of Commerce in the usual way. Samples (not less than 80 lb.) representing the average quality of wheat in the different districts were obtained through the Farmers and Settlers' Association, Agricultural Societies, and shippers and millers. Those from the northern, western, and southern districts (the latter subdivided into north of Junee and south of Junee) were weighed separately, and the average obtained for these districts.

The average for the State was arrived at by taking the mixed samples from the different districts in the following proportions :—

Northern, 2-8.

Western, 1-8.

Southern, north of Junee, 2-8 ; south of Junee, 3-8.

The sample thus obtained was thoroughly mixed, and the weight taken, like all the rest of the weights, on McGuirk's patent scales, in which the full Imperial bushel is weighed.

The weight for the F.A.Q. wheat has been fixed for the current year at 61½ lb. per bushel—rather a low result when compared with previous years, or with the current F.A.Q. weight in the other States. Fortunately it does not imply inferiority of quality.

The following are the milling notes on this sample :—

Appearance of grain : Dull white, soft, large, fairly plump.

Weight per bushel : 61½ lb.

Ease of milling : Easy to mill.

Percentage of mill products : Flour 69·7 ; pollard, 14·0 ; bran, 16·3.

Nature of flour : Colour of flour, excellent ; strength of flour (quarts of water absorbed by 200 lb. sack), 48 ; percentage of dry gluten, 12·2.

The bran was clean and of medium size, pollard clean, semolina slightly yellow and rather soft, gluten yellow, coherent, elastic, soft.

The striking feature of this season's F.A.Q. wheat is the high gluten content. This is higher than it has ever been within my knowledge, and agrees with the remarkably high gluten contents obtained in individual cases, particularly from the drier districts of the State. Not only are the hard and medium hard wheats, for example, grown at the Government Farm at Cowra by Mr. Sutton, more than usually rich in gluten, but even the soft wheats, which are usually low in gluten, have given in individual instances as high as 18 per cent. dry gluten.

The flour-strength is also gradually increasing, and these characteristics are shown in the following table, which gives the results of the examination of the F.A.Q. sample since 1906 :—

1905–1906.—Appearance of grain : Dull white, medium size, soft, slightly bunty ; weight per bushel, 62. Percentage of mill products : Flour, 70·5 ; pollard, 14·4 ; bran, 15·1. Nature of flour : Colour, excellent ; strength (quarts of water per sack of 200 lb.), 45·5 ; percentage of gluten, 10·2.

1906–07.—Appearance of grain : Dull white, medium size, plump, soft ; weight per bushel, 62¼ Percentage of mill products : Flour, 71·0 ; pollard, 11·8 ; bran, 17·2. Nature of flour : Colour, excellent ; strength (quarts of water per sack of 200 lb.), 46·1 ; percentage of dry gluten, 9·4

1907–08.—Appearance of grain : Dull white, medium size, plump, soft ; weight per bushel, 62½. Percentage of mill products : Flour, 68·2 ; pollard, 15·2 ; bran, 16·6 ; Nature of flour : Colour, excellent ; strength (quarts of water per sack of 200 lb.), 48·5 ; percentage of dry gluten, 10·6.

1908–09.—Appearance of grain : Dull white, large, fairly plump, soft ; weight per bushel, 61½. Percentage of mill products : Flour, 69·7 ; pollard, 14·0 ; bran, 16·3. Nature of flour : Colour, excellent ; strength (quarts of water per sack of 200 lb.), 48·0 ; percentage of dry gluten, 12·2.

The above figures show satisfactorily that the locally-grown wheat is improving distinctly in character, as evidenced by the higher milling value shown by the F.A.Q. standard in each succeeding year.

These tests were not made before 1906, but from the examination of typical wheats from different districts made in the laboratory before that date, the evidence is still more conclusive that the class of grain grown locally is undergoing gradual but considerable improvement, more particularly in the matter of flour-strength—a quality that is becoming more and recognised as of the first importance in determining the value of grain in the markets. We are still a good way behind some of the Canadian and American wheats in this respect, but the results of testing of locally-grown strong-flour wheats show conclusively that we can cultivate these wheats successfully, and a further improvement in this respect and a corresponding increase in the value of our wheat and flour may be confidently expected.

Butter Factory Supplies.

GRADING THE RAW MATERIAL IN DENMARK.

C. PEDERSEN, Dairy Instructor.

ONE of the latest systems of some importance, introduced into Denmark in connection with the improvement in butter, is the grading of the milk on its arrival at the factory. Although grading the milk has not been generally adopted, the good work done seems to assure its general adoption before very long. It was commenced by a number of factories forming themselves into associations, termed Milk Judging Associations.

Only such a number of factories form an association as can be worked by one person. The persons engaged as graders are thoroughly acquainted with, and are good judges of milk. They give reasons for the faults and suggest remedies.

Below I give the results of four of these associations on the Island of Fyen for last year, from which it will be seen that many faults, which, to the average dairyman seem of very little or of no importance in the production of the raw material, are of some magnitude in the eyes of experts. All those mentioned hereunder are faults we meet with in our State every day—in fact, many times a day on our cream-grading floors in the butter factories. But as we have no associations of this kind to take such matters in hand here, it will probably be a long time before we see strict cream grading supported by neighbouring factories.

RESULTS from the four Associations.

Association's number.	Number of Suppliers.	Per cent. of Suppliers in—			Per cent. of Suppliers have delivered—Milk returned owing to—										
		1st class.	2nd class.	3rd class.	Unclean cans.	Rusty cans.	Unclean milk.	Sour milk.	Tallow taste.	Bitter taste.	Feed taste.	Different tastes.	Stable smell.	Bad smell.	Badly strained.
1	1,185	65	29	6	4	14	6	2	...	3	2	...	1	6	...
2	1,519	75	23	2	6	5	3	2	...	...	...	1	...	8	1
3	1,106	71	28	1	5	21	19	5	1	...	...	1	...	4	...
4	1,289	77	22	1	2	9	8	6	...	...	...	.	3	2	1
Average...	1,275	72	25·5	2·5	4	12	9	4	·25	·75	·50	·50	1	5	·50

PER CENT. of Suppliers in the different classes in first and last judging during the year.

Association's number.	First Judging. 1st class	2nd class.	3rd class	Last Judging. 1st class.	2nd class.	3rd class.
1	28	59	13	78	18	4
2	50	45	5	78	21	1
3	58	41	1	83	17	...
4	56	40	4	73	26	1
Average ...	48	46	6	78	21	1

As the above is the result of the first year's operations of the associations, it must be admitted that the work has done much good to the factories and suppliers of same, as it has caused an increase in the amount of first-class milk from 48 per cent. to 78 per cent., and reduced the amount under second-class from 46 per cent. to 21 per cent., and the third-class from 6 per cent. to 1 per cent.

A year's work of this kind means a large amount of money to the suppliers whose milk has been improved to first class.

Sawdust and Gypsum as Food for Cattle.

It has recently come to light, reports the Consulting Chemist of the Royal Agricultural Society of England, that for some months past there has been on the market a material sold variably under the name of "Shudes" or "Shude Meal" which instead of being (as Shudes ought to be) the outer coating, or husk, of cereal grains such as oats, rice, &c., is composed of sawdust and sulphate of lime (gypsum). The sawdust is finely ground and the gypsum acts as a "facing" or polish to it, and gives to it the appearance of having attaching flour on it. On mixing the material with water, however, the gypsum can be separated, and appears as a deposited white powder, while the lighter sawdust can be removed and be detected by microscopical examination.

The material has been traced to be offered to millers, under the name "Shudes," by a Liverpool firm, price £2 12s. 6d. per ton. f.o.b. Liverpool, bags included, less $1\frac{1}{4}$ per cent. cash in seven days, and is described by them as "No. 18 Shudes." A sample envelope is sent round, containing some of the material, and having printed on it the names of other feeding materials, such as Seconds, Thirds, Pollards, Barley Meal, Rice Meal, &c., as well as "Shudes."

Similar offers for the like material have been sent out, for "No. 1 Shude Meal" at 55s. per ton, f.o.b. Liverpool, by another Liverpool firm.

The material has been found to be sent out by millers, either in the unmixed state, or compounded with other materials as "Pig Meal," or else to be mixed with "Sharps" and other offals, for the purpose of adulterating them. In one instance that came to light a miller had, for the last six months, been receiving the "Shudes" regularly at the rate of 8 to 10 tons per month, and had been mixing them with meals so as to enable him to compete successfully with his rivals in putting a "Pig Meal" on the market at a moderate price.

Examination of samples of these "Shudes" and "Shude Meal" proved them to be composed of nothing but the sawdust and sulphate of lime already spoken of, both of which, needless to say, are worthless for feeding purposes, and the use of which with feeding materials constitutes, unless their presence be declared, an offence under the Fertilisers and Feeding Stuffs Act (England). The composition of the material has been, generally, about 45 parts of sawdust to 55 parts of sulphate of lime (gypsum).

An instance where material of this kind was used to adulterate "Sharps" is the following:—

A member of the Society, residing in Nottinghamshire, sent me, on August 19th, for analysis, a sample of "Fine Sharps," which he said he had bought from a miller, for pig feeding, at 14s. 6d. per bag of 16 stone, and he added that he was not satisfied with the quality. I reported that the sample contained:—

Mineral matter	16·04 per cent.
Including sulphate of lime	12·97 ,, ,,

and I added, "this is not genuine 'Sharps,' but is adulterated, and contains 13 per cent. of sulphate of lime."

Though I made every endeavour to obtain the full particulars of the transaction, the purchaser was unwilling to supply these. There is no doubt, however, that the adulterating material used was the same as that mentioned above.

Fruit Growing in our Arid Districts.

E. HARRIS.

No rain since October, 1908, and yet Mr. F. A. E. Fisher, of Willow Grove, Booroorban (24 miles from Hay), sends to the Department a box of fine Elberta peaches, Satsuma plums, figs, and grapes, as proof that fruit can be grown in a dry climate if only intelligent and modern methods of cultivation are adopted. Seven months without rain would certainly spell disaster to many Cumberland orchardists, yet Mr. Fisher is able to show large, finely flavoured, and juicy fruit, which last received a watering in July, 1908, and then not enough, "on account of the dry season."

Let Mr. Fisher tell his own story :—

They are all grown under same conditions, the ground being loamy sand, with a clay subsoil about 18 inches down. The garden strip is about 70 yards wide, and runs through the country in varying widths. Pine, kooba trees, &c., grow along the course of it. I plough up my garden in July about 8 inches, and then again in September or October, and harrow occasionally after rain. The past twenty-seven months, since October, 1906, there has been about 20 inches of rain. Last year, 1908, the rainfall here was 9½ inches ; no rain since October, 1908—not more than 70 points all told. The Wargam Station records are at the Observatory for the last twenty or thirty years, and I am 3½ miles south of Wargam Home Station.

There are many spots all over the Riverina where fruit, such as peaches, apricots, figs, plums, and grapes can be grown to perfection by rainfall only. These "spots" are sand or loamy holes, slightly lower than the surrounding country, and the water can be drained into them by a few plough furrows run in different directions, and cleaned out either with scoop or shovel. The greatest drawback is the lack of shelter, but where the patches are large enough, pepper-trees can be grown in shelter belts. When the patches are small, old man saltbush makes a splendid break. Many of the patches are damp within 2 or 3 feet of the surface, and, with ordinary cultivation, there is never any lack of moisture. One inch of rain will water almost any patch with four drains, and one or two waterings a year are sufficient. Many places can be watered by 60 or 70 points.

A bank high enough to keep out the water in very wet years is required, but a bank a foot high is enough for this in our flat country. I know of places on the open plains 20 acres in extent, all sandy loam down 10 to 20 feet, and damp all the way down. Not one person in a hundred utilises them, and yet they would grow any of the fruit mentioned to perfection. The very best patches of all are found at the foot of the sandhills. The water off the surrounding plains run into these places, and the soil is a beautifu sandy loam. Of course, unless the spot for the garden is slightly lower than the surrounding catchment, it is no good ; but in different parts of the country, when it is hilly, the hills could be used as catchments if the soil was good at the foot. I may mention the last watering this fruit got was in July, and then not enough, on account of dry season.

If the example set by Mr. Fisher be followed by other residents of our western plains, to whom fresh fruit and vegetables during the hot season would be a comfort, then he has done good service in letting us know what can be done under adverse circumstances.

Orchard Notes

W. J. ALLEN.

March.

The rains which fell during last month have revived the trees and vines, and in many places the fall was sufficient to soak the soil to a good depth. This will have the effect of filling out the later fruits such as apples, late pears, peaches, and grapes. Unfortunately, the latter crop is light in many districts, owing to the heat wave experienced in the beginning of the year.

Fruit for Export.—Fruit intended for export should be fully developed, but a little on the under ripe side ; not too much so, however, else it will wither in transit, and for such fruit there is no demand. On the other hand, if the fruit is ripe when picked, it will reach its destination in an over-ripe condition, and, in consequence, will not find great favour with buyers, but fruit picked while slightly under ripe, will improve on the voyage, and should (if handled and carried properly) land in prime condition. Jonathans and Rome Beauties should show some colour before being picked.

The work of picking is best carried out in the cool of the morning, and the fruit should be handled as carefully as eggs, so as to avoid bruising. It should be graded evenly for colour and size, and wrapped neatly in proper paper, and then packed securely in good strong, clean, new cases, neatly and legibly stencilled, giving the name of the variety and grower, or shipper, in each case, and, if possible, the number of apples in such cases, as well as the grade—that is, whether they are selected, specially selected, or choice ; but never put first, second, or third grade, as the quality of all the grades should be equal, the only difference being in the size and colour.

When picked under ripe, some varieties of fruit will, during certain seasons, develop black spots on the voyage similar in appearance to the Bitter Pit ; it is best, therefore, to see that such varieties are not picked until they are about ripe, in which case the fruit is not so liable to become so marked.

Cover Crops.—After harvesting, the most important work to be carried out this month is the preparation of the land to receive cover crops, attending to pests, and preparing any land which is to be planted this coming winter ; as well as the ordering of the necessary trees.

Where it is the intention of the orchardist to sow cover crops this fall among the trees or vines, it will be well to have the land prepared and the crop put in by the end of this month. Grey field peas, black tares, and rye may be sown, the last named being the quickest growing crop. Last season's

experience taught us to put this crop in early in the fall, and get it ploughed under early in the Spring, while the land has sufficient moisture left in it to plough well.

Codlin Moth.—Continue to examine the bandages on all trees in orchards carrying fruit, and for a few weeks after the fruit is picked occasional grubs will be found. The bandages should be 9 inches wide before being folded, wrapped round the trunk of the tree and fastened with a copper nail. The bandage should be doubled back about the middle, with the loose edges hanging downwards and fastened securely to the tree.

Planting.—Wherever there is sufficient moisture, the latter part of this month is a good time to plant out young strawberry plants.

Where young orchards are to be planted, the land should be put in condition as soon as possible, so that it may be in readiness to receive the trees by June, which is one of the best months for the planting of deciduous trees.

Cooma.—While at Cooma, on the 5th of February, I saw some of the finest apricots I have seen this season, beautifully large, clean fruit, which would find a ready sale anywhere, particularly for canning purposes. There were also some very fine plums, and good crops of apples in most of the orchards of that district.

Red Spider.—The Orchardist at Wagga orchard reports as follows, in connection with the treatment for red spider:—After trying Coopers' sprays, V One and V Two, Tobacco wash, and other washes, I have found that the most successful spray I have used is the sulphur and lime spray, in the proportion of 12 lb. sulphur, 6 lb. lime, to 100 gallons of water. Take two 5-gallon drums, three parts filled with water, bring to the boil, mix sulphur to a paste, and add to boiling water. Slack the lime in boiling water until it comes to the consistency of thick cream, mix the two together and boil for about an hour, after which dilute to 100 gallons of water.

Stock Solution.—Take $\frac{1}{2}$ cwt. of lime, place in a 40-gallon barrel, gradually add water, stirring constantly, until it is thoroughly slacked, then fill the barrel to within a few inches of the top with water, thoroughly stir, and allow to settle. Provided the lime is always covered with water, it can be used in the required proportions, and will keep for an almost indefinite period in this way, whereas, if it is allowed to lie about, it becomes air-slacked, and, consequently, of no use for spraying purposes.

New Evaporator.—This is now running satisfactorily, and at a recent trial with prunes it took only seven hours to cure. The fruit, after being cured, can be cooled, if required, in a few minutes, by opening the doors of the evaporator, and running the fan, which draws the cool air over the cured fruit, cooling it quickly.

District Notes.

Hawkesbury.

H. W. POTTS, Principal, Hawkesbury Agricultural College.

MARCH, April, and May are always recognised as the farmers' busiest season. It is inaugurated this year under favourable auspices. The soils are moist, friable, and warm.

The weather reports for the past month were favourable to good farming conditions, in marked contrast with those furnished for the previous month. Substantial falls of rain, many as a result of thunderstorms, have given us enough moisture to maintain steady growth in the late crops of maize, sorghum, and millet.

Silage.—The late spring crops of maize intended for silage have grown well and given yields ranging up to 12 tons to the acre. The past fortnight has been a busy one in cutting, carting, chaffing, and siloing. The stores of silage this year are vastly ahead of those of past seasons, and point to full milk supplies throughout the winter, wherever stall feeding is practised.

Dairy stock are further favoured now with a fresh spring of grass, the outcome of the late rains and low temperatures. Moreover, during the past six weeks there has been an abundance of green feed from maize, sorghum, and millet. The milk yields in consequence are satisfactory and above those recorded during recent seasons.

Maize and Sorghum.—The crops sown in January and February germinated freely and rapidly. To ensure vigorous growth this month it will be necessary to maintain persistent shallow cultivation to conserve moisture and check the growth of weeds. These crops will assist in providing green forage for dairy cattle up to midwinter. In this connection farmers may be reminded that sorghum always demands more cultural attention in its early stages of development than maize. The period of delicacy once outstripped then the plant becomes robust, the growth assured, and the latter period is characterised by greater sturdiness and a power to resist frost not possessed by maize. Hence we rely on sorghum to provide green feed for stock in the early stages of winter. It is possible this season that we may have a surplus, and in such case it can always be stored in the form of stack silage. Another method of utilising this attractive fodder is to cut, stook, and dry the crop as hay. Sorghum hay possesses a food value rarely tested. It can be chaffed and introduced in well combined proportions with other foods to afford a balanced ration for stock or horses.

Hungarian Millet.—A final crop of this useful green fodder may be sown now, in order to afford a heavy growth just before the advent of the early frosts. We all readily admit the value of this crop for feeding dairy cattle. It is also very serviceable for conservation as silage.

Crops for Green Feed.—Attention must now be paid to sowing crops for early green forage, and amongst the useful sorts may be particularised the macaroni or durum wheats. They are hardy, rust and drought resistant. The plant possesses smooth, broad, succulent leaves, and grows tall. They thrive well in light loams. Farrar's Durum and Medeah are the best varieties for this district. The crop may be cut early when quite green and top-dressed with superphosphate—1 cwt. to the acre—harrowed in. The ensuing crop invariably affords a good yield of hay. It must be cut before the head forms and becomes harsh. Other wheats for the early crops of hay may be sown towards the end of the month after ploughing the ground twice and the addition of a full manure of blood, bone, and superphosphate—100 lb. to the acre. Our recent experience points to Farrar's wheats, known as Plover, John Brown, and Comeback, as the best yielders and freest from rust. The land may be cultivated for the main crops of cereals to be sown a month later.

Oats.—Again our aim is to put in a crop for early green feed, with suitable cultivation and a manure similar to that recommended for macaroni wheats. The potato oat has in the past given us highly satisfactory results, as also has White Tartarian. In making provision for a well-balanced green ration it will be advisable to grow with oats or barley, vetches or peas.

Barley.—Skinless barley invariably gives an early crop of palatable green food in the earliest period for dairy stock. On the light sandy loams of this neighbourhood the most effective manure to add is 2 cwt. of superphosphate with ½ cwt. of nitrate of soda to the acre. Cape barley has also given splendid results.

Rye.—The hardiest of our cereals has always had a place on our poorer loams. It is easily grown under the most adverse conditions. It is not so palatable or nutritious as other cereals, but it is always a certain crop. Emerald and Thousandfold are the best varieties.

Turnips, Swedes, Kohl Rabi, Tree Kale, and Thousand-headed Kale may be sown now. In each case select deep rich loams. White mustard may also be sown this month.

Rape.—The knowledge of this plant's value is becoming annually more widespread. Rape is a crop that must occupy an important position in the rotation. It is an excellent catch crop and supplies a rich, relishable, and juicy food for all classes of stock, including poultry, and more especially sheep. Where the land is mellow and rich, rape will provide a food as rich in nutrients as clover. The soil should be brought to a fine tilth. Sowings put in this month will give a good crop in the latter part of May. Sow broadcast 6 lb. seed to the acre. The variety with the best reputation is Dwarf Essex. Where a firm seed-bed has been prepared, with reasonable moisture, followed by rolling, the germination of the seed should be very rapid, and vigorous growth of the plant should result. When fed off by stock the ground is left in a high condition of fertility for any deep-rooted crop to follow.

Lucerne.—The autumn is the best time to make further sowings of this, the most valuable of all fodder crops. A good, well-drained, friable soil with deep, penetrable subsoil is the best. Where light loams are available the plant responds well. In all cases the land must be clean. A catch crop of cowpeas is a suitable one for preparing the soil.

BATHURST.

R. W. PEACOCK, Manager, Bathurst Experiment Farm.

Wheat.—The earliest sowing of this cereal should be made towards the end of the month, if it is intended to feed it off with sheep during the winter. The poorer and lighter portions of the farm should be sown first. Early sowing generally ensures vigorous root development; the fibrous roots throughout the soil prevent it getting out of condition by the action of the winter rains. Late-maturing or mid-season varieties should be chosen for the early sowings. Purple Straw, Chant's Prolific, Lammas, Tuscans Manitoba, Cleveland, Tarragon, and such wheats, would be suitable, leaving Federation, Bobs, Bunyip, Comeback, &c., for the later sowings. Wheats which stool freely are more suitable for feeding off than those of more erect habit of growth in the early stages. A sowing of an early variety may be made about the beginning of the month for green winter fodder.

Barleys.—These should be sown early in the month for green winter fodder. The Cape and Skinless varieties are suitable for this purpose. The Skinless is earlier than the Cape, but does not stand the winter as well, and the second growth is not so satisfactory. They require the soil to be in good heart, with a fair quantity of available plant-food near the surface. Paddocks which have received a good dressing of farm-yard manure, also old stock-yards and sheep-pens, are very suitable, as the manure or organic matter keeps the soil warm, and growth is maintained throughout the winter.

Rye.—Sowings should be made early in the month for green winter fodder. Rye possesses the advantage over other cereals of producing fair yields from poorer soils, and also withstanding greater degrees of cold. It is valuable for poor soils. The Black Winter and Arctic varieties are the best for early winter fodder.

Tares and Field Peas.—These may be sown for fodder or green-manuring during the month. When sown in conjunction with the foregoing cereals they add materially to the quality of the fodder. The Black tare and the Grey field pea are two of the best for these purposes. To add nitrogen to the soil these and allied plants are valuable in a rotation. Their principal defect is their rather meagre growth throughout the autumn and winter. Their main growth is during the spring, and weeds are apt to mature before these crops are at their best for grazing. They also provide fodder when generally speaking, it is plentiful.

Scarlet Clover.—This annual may be sown. It is hardy, and its fibrous roots keep the soil throughout the following summer in a most desirable condition. It has the same defect as regards weeds as tares and peas, and these three, wherever practicable, should be sown upon clean land. Its main growth is in the spring, and it rarely grows sufficiently to provide much winter fodder.

Rape.—Should be sown early in the month. It requires well-prepared land and is a rapid grower, of excellent fodder value, especially for ewes and lambs. It is a moderately deep rooter, its thick main roots make desirable air channels in the subsoil. It withstands a fair amount of dry weather, and its vigorous autumn growth makes it one of the best crops for winter fodder. It also smothers weeds, and the stocking which it allows during autumn, winter, and spring, practically annihilates the weeds peculiar to the wheat season. When other feed is plentiful in the spring it may be allowed to run up to blossom, the whole to be advantageously ploughed under about November. This practice allows of the residues to decay and the land to lie fallow for several months in such a condition to be most receptive of rains. When treated in this way it is perhaps the very best crop in rotation with wheat, where sheep and wheat are the principal lines. Cape barley may be sown with it to advantage, the rape and barley to be sown in alternate drills. Care must be taken that neither the barley nor rape produces seed before being ploughed under in the spring.

Lucerne.—This plant deserves special attention, it being one of the most nutritious and prolific of fodder plants. Its long tap-roots enable it to throw out green leaves during dry summers when other plants of the pastures are brown. It should be sown towards the end of the month, if the weather is favourable, upon deeply-worked, well-prepared soil. As it occupies the land for several years, good thorough cultivation is well repaid by the better stand and more substantial yields than are obtained by more slipshod methods. It is better sown without a shelter crop, as it does much better alone, and should be sown early in order that it may establish itself before the dry weather of the ensuing summer. It thrives best upon rich alluvial soils, unbroken by any stratum of coarse sand or gravel. Upon the lighter soils it produces a fair amount of fodder, and will last for several years without replanting. It is valuable in rotation both as a nitrogen gatherer and subsoiler.

Grasses and Clovers.—Many perennial grasses and clovers should be sown during this month upon well-prepared land. When sown during the autumn they establish themselves, and are the better able to withstand the dry summers which are the rule. Barley Grass and Barren Fescue (or Silkygrass) which appear so profusely as weeds, interfere considerably with the successful cultivation of many of the grasses. The dry summers are very trying in this district for all the perennial clovers.

Sheep's Burnet.—This valuable fodder plant should also be sown. It is extremely hardy, and grows throughout both winter and summer. It is valuable for the very light soils, upon which I would recommend Cocksfoot

to be sown with it. The fibrous roots of the Cocksfoot keep the surface in condition, whereas the roots of the Burnet act as subsoilers. Burnet has the advantage over lucerne, in that it does not induce hoven in sheep or cattle.

The *Growing Crops*, such as swedes, kale, &c., will require cultivation and keeping free from weeds. The early maize may be ripe enough to harvest and the stalks could be advantageously siloed with a proportion of green lucerne. Molasses and water should be added to make good the deficiency of moisture in the stalks. Excellent silage is obtained in this way.

Vegetables.—Sow onions, leeks, eschalots, Savoy cabbage, broccoli, mustard and cress. Transplant Savoy cabbage, broccoli, onions, leeks, and eschalots.

New England.

R. H. GENNYS, Manager, Glen Innes Experiment Farm.

Barley may be sown at this time for green fodder for latter part of the winter and early spring. The best varieties in this connection are Cape and Skinless barley, the former being well known. Skinless is very sweet, but does not stand frost too well, it is a poor stooler, and must, therefore, be sown thickly. It has this advantage, that after being cut for green fodder, when the latter becomes plentiful, it makes good hay, being sweet and devoid of beards.

Rye.—Emerald and white rye may be sown for green food, and they are a capital standby, growing in fairly poor soils, and standing the grazing of stock well. They are not so sweet as wheat or barley, but their hardy nature enables them often to give a bite when all else fails. To leave for straw and grain the white rye does the best here, and is capital for collar-making. Emerald is a generally useful variety, and Thousandfold provides perhaps the best bottom for grazing on of the three. All make good thatch.

Poland Wheat, sometimes wrongly named Mammoth Rye, is also a hardy winter fodder for stock.

Wheats.—Manitoba wheats are the best for feeding off in winter, as they stand the frost so well. They may be sown any time this month and fed off till August, when, if it is intended to keep them for grain or hay, stock should be removed. Sometimes the plan answers well, but, as a rule, the fed crops will not yield as well as the unfed, except in the case of too rank growths when any wheat should be eaten off, but not too close, nor in wet weather. Better to put a lot of stock on, and eat down quickly than leave a few on for a greater length of time.

Tares and Vetches may be sown in combination with ryes or barleys. The former are good for ploughing in in orchards, &c, supplying abundance of organic matter.

Vegetables, such as cauliflowers, cabbages, and the like, may be sown, and also onions.

Riverina.

G. M. McKEOWN, Manager, Wagga Experiment Farm.

Wheat for Hay.—As March and April are the best months for sowing wheat for hay, in this and similar districts, this work should be pushed forward without delay. The dry conditions and high temperature of the last few months will have made the work difficult in some soils in which fallowing has not been carried out. For stubbles or other unbroken land the rotary disc plough will be found an invaluable dry-weather implement. There are various designs of these implements now on the market, which will prepare an excellent seed-bed with the greatest speed and economy, the pulverisation of the soil and the depth of the work being excellent. The land should be ploughed as deep as the nature of the soil will admit.

Forty-five pounds per acre of plump seed will be found ample under local conditions. Zealand or Berthoud, White Essex, White Lammas, and Australian Talavera, will be found among the best kinds, as the white varieties make hay of far better appearance than that of the purple straws. It also weighs better, and is better liked by stock. Of the purple straws, Marshall's No. 3 makes about the best hay, provided it is cut while quite green.

The Wagga Experiment Farm returns from Zealand wheat cut for hay in last season are as follow, viz. :—

	a.	r.	p.	tons	cwt.	qrs.	lb.
1. Fallowed land, 11½ acres ...				28	18	3	8
2. Early ploughed stubble, 33 acres ...				83	11	3	26
3. Early ploughed stubble	11	1	24 ...	24	1	1	2
4. ,, ,, ,,	78	2	16 ...	178	3	1	19

Block No. 1 was sown on fallowed land, the seed being sown at the rate of 40 lb. per acre; 56 lb. per acre of No. 1 manure was drilled with the seed. Block No. 2 was sown on stubble land which was disc-ploughed 6 inches in January, and well pulverised by the operation of the discs in ploughing and by harrowing and rolling. Seed was sown at the rate of 45 lb. per acre with 56 lb. per acre of No. 3 manure. Block No. 3 was treated in the matter of tillage in exactly the same manner as Blocks 2 and 4, with the exception that it was not rolled after sowing as was the case with Nos. 3 and 4. Nos. 3 and 4 were intended for direct comparison with each other, the result showing a yield from Block 3 of 2 cwt. 3 qrs. 9 lb. of hay per acre less than that harvested from No. 4, which was rolled both prior to and after sowing.

In ordinary seasons when the rainfall ranges from fair to good we leave, as long as possible, the ridges of pulverised soil as thrown up by the seed drills, thus improving the capacity of the soil to receive moisture, and at the same time affording shelter to young plants. Rolling before sowing is preferred to rolling after sowing, the latter only being carried out when there is a probability of the season being very dry. In ordinary seasons it is preferable to roll after the crop is well grown, thus preventing the surface from compacting

or crusting if it has a tendency to do so when rolled immediately after sowing. Rolling of wet soil should be avoided. Following is the record of rainfall for the year 1908 :—

January ...	nil	May ...	69 points.	September...	320 points.
February...	219 points.	June ...	303 ,,	October ...	126 ,,
March ...	8 ,,	July ...	181 ,,	November..	43 ,,
April ...	84 ,,	August ..	108 ,,	December..	23 ,,

Rape.—Should be sown without delay in finely prepared land. For full details as to preparation of land, &c., see *Gazette*, June, 1908.

Richmond River.

H. R. ALEXANDER, Manager, Wollongbar Experiment Farm.

Farming operations during March will be confined principally to harvesting early maize, or converting into silage any available crops of maize or sorghum. These crops can be easily stacked, and, if reasonable care be observed, the waste from stacks will not amount to much.

As early summer crops are removed, the land can be prepared for crops suitable for winter green feed.

Oats and Field Peas.—Towards the end of March or during April, oats may be sown. Algerian is about the only variety that can be recommended for this humid district. Algerian, though not immune to attack, is so far the best rust-resister of the different varieties of oats tried at Wollongbar. Sow broadcast 2 bushels per acre.

A mixture to be recommended for green cow feed is 1½ bushels Algerian oats and 1 bushel blue field peas, sown broadcast, per acre.

The peas grow remarkably well in this locality, and are relished by stock ; being rich in protein or milk-making matter, the peas balance up the otherwise somewhat washy ration of green oats. Peas are also of considerable value in maintaining the fertility of the soil.

Rye can be sown towards end of March or during April. Rye will flourish where oats, barley, &c., would not show to advantage. As a fodder, rye is only of value in the green state, should be kept well eaten down, and is of no value as hay. The straw makes good bedding, and limited quantities can be sold to saddlers for stuffing collars, &c. Sow 1½ bushels per acre broadcast. Emerald rye is recommended.

Rape for pigs.—For green pig feed a portion of the pig run should be sown with rape. If sown during April the crop will be fit to feed off by July, a time when green feed for pigs is somewhat scanty. All classes of pigs thrive on rape. Sow 10 lb. of Dwarf Essex per acre broadcast.

Shade Trees.—March and April are the months best suited for planting evergreen trees. The need for shade trees calls for urgent attention in this district. Camphor laurels grow rapidly, making handsome trees in a few years. In this district the Weeping Fig (*Ficus benjamini*) and Moreton

Bay fig (*Ficus macrophylla*), surpass all other evergreen trees for shade purposes, and, although somewhat slow in growth, once established are there to stay.

Vegetables.—In the vegetable garden March is a busy month. The winter crop of potatoes must now be sown. Towards the end of March sow onions. Hunter River Brown Spanish seed is recommended ; also plant carrots and parsnips. Make small sowings in beds for transplanting of kale, cabbage, cauliflower, and lettuce. Sow French beans and peas. In sheltered localities free from frost, beans can be grown throughout the winter, and are a most profitable crop. During April the main turnip crop should be sown.

Clarence River.

A. H. HAYWOOD, Manager, Grafton Experiment Farm.

The rainfall for the Clarence, especially at Grafton, Ulmarra, and Copmanhurst, has been much below normal for the past three months, and the country now (17th February) presents a very uninviting aspect. Stock are being moved to other localities. The early maize crops, it is estimated, will only return about half the usual yield, and hundreds of acres of maize have been cut for green feed. The outlook is very bad for winter feed and the late maize and potato crops unless good rains soon fall.

Lucerne.—Sow this month and next. On land that has been worked some years it will be necessary to apply a fertiliser, rich in potash (sulphate) and phosphoric acid (superphosphate) in the proportion of one of the former to four of the latter. This dressing will foster the young plants until the tap roots descend to the subsoil, and the plants' future is then assured.

On most of the soils here 20 lb. of seed per acre should be sown. On purchasing seed insist on a guarantee that the seed is free from dodder.

Maize.—Maize for green feed may still be sown. The system favoured here is to plant seed twice as thick as for grain, in drills 3 feet apart, the result being that the ears are choked down to about half their normal size and the stalks rendered more slender, which is an advantage when fed whole.

In *Feeds and Feeding* by Henry on *Thickness of Planting and Nutrients*, the experiments were carried out at Illinois Station, and at the end of three years' study the conclusions drawn were that thick planting, viz., one grain every 3 inches in drills 3 feet 8 inches apart, gave more nutrients per acre than at other distances.

Potatoes.—The middle of February is the favoured time for planting the late crop here. This year, however, on account of dry conditions, very little planting was done in February. Fertilisers are more likely to be beneficial to the autumn crop than the early crop. Potash is the dominant manure for tubers ; but the other elements, viz., nitrogen and phosphoric acid, should not

be omitted, especially on soils partially exhausted. On such soils a green manuring crop previously ploughed in will be of great advantage.

Combination Crop for Winter Feed.—Algerian oats and tares, 1½ bushel of oats to 1 bushel tares. This will provide a milky food for winter.

Rye or barley may be planted in the same way.

Rape may be sown 6 to 7 lb. per acre broadcast; with care, it may be fed to cattle.

Swedes.—A small area should be devoted to this useful crop. Sow in drills 2½ feet apart, about 2½ to 3 lb. of seed per acre. The young plants need thinning out when 3 inches high to about 12 inches in the drill.

Pasture Grass Mixture for this District.

	Per acre.
Prairie	10 lb.
Cocksfoot	20 ,,
Red Clover	2 ,,
Perennial Rye	5 ,,
Lucerne...	1 ,,
Paspalum	2 ,,
White Clover	2 ,,

The above mixture was tried here last year, and has given most satisfactory results. May be sown March or April.

Vegetables.—The following vegetable seed may be sown:—Beans (French), peas, onion, cabbage, cauliflower, beet. Transplant, during showery weather, seedlings of cabbage and cauliflower. Successive crops of these, excepting beans, may be made next month.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Sub-Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

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The Wentworth Irrigation Area.

E. HARRIS, Department of Agriculture.

Irrigation.

IRRIGATION is the most scientific form of farming. The experienced irrigationist thinks it would be quite as illogical for him to leave the watering of his land to the caprice of the clouds as for the housewife to defer her washing-day until she could catch rain-water in her tubs. The best results from irrigation are obtained in arid countries. Arid districts, it is a well-known fact, are much more fertile than those possessing an abundant rainfall. It is stated that in America the soils of the western arid regions contain on the average three times as much potash, six times as much magnesia, and fourteen times as much lime as the soils of the eastern districts. These ingredients, in humid regions, are carried away in the drainage of water, or into the subsoil below the reach of plants, but in dry districts have remained and accumulated in the soil for centuries.

The arid districts of New South Wales are equally as rich as the arid districts of other countries, but the area of arid lands is far in excess of the water that will ever be available to irrigate it. Any opportunity of securing irrigated lands in New South Wales should, therefore, be taken at once. Such an opportunity now exists on the Wentworth Irrigation Area under the most favourable conditions.

Its Situation.

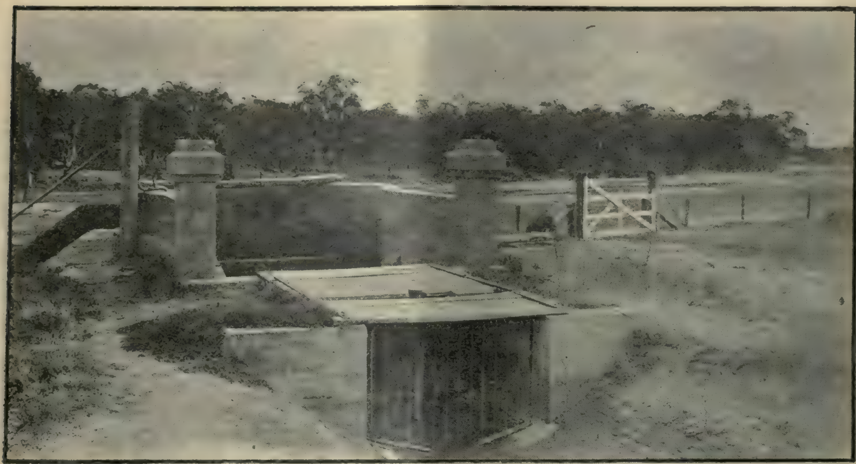
Wentworth is situated in the south-west corner of New South Wales, at the junction of the Murray and the Darling. The near-by settlement of Mildura is 351½ miles from Melbourne by rail, and 15 miles from Wentworth; and that route is the most convenient for reaching the area in summer. The River Murray depends for its main supply on the snow and rain falling on the Snowy Mountains and adjacent ranges, and is navigable for steamers about eight months during the year—from about June to January, inclusive. During that period there is communication by water, *via* Adelaide.

The Irrigation Area.

The area consists of 10,000 acres of land, situated in the eastern angle between the Darling and Murray rivers. Up to the present an area of 1,113 acres have been subdivided into blocks of 7 to 35 acres, in such a manner that each block receives the water at the highest point, and slopes to the natural drainage lines, thereby minimising the amount of grading required to prepare the land for irrigation. The area under lease is 921 acres, and the area available for lease, including 84 acres which have just been subdivided, measures 276 acres, in twenty-five lots.

The Irrigation Plant.

The pumping plant consists of a Robison centrifugal, driven by a horizontal engine of 60-horse power, capable of discharging 4,000 gallons of water per minute. The water is conveyed from the pumps to the land to be irrigated by means of channels, which are 2 feet wide at the bottom, 3 feet 6 inches deep, and with batters of $1\frac{1}{2}$ to 1, giving a depth of 10 feet 6 inches on top. Nearly 8 miles of these channels have been constructed.



Wentworth Irrigation Area—Pump Discharge Basin and Water Meter.

Supply of Water.

The supply of water to each block is on the most generous proportions, and is ample for all requirements. During the summer months, from the beginning of September to the end of February, waterings are given every three weeks, and from the 1st March to 31st August the waterings are once a month. The quantity of water varies with the demand, and averages from $3\frac{1}{2}$ inches to 5 inches per acre of the area watered. That is to say, the Wentworth Irrigation Area enjoys the equivalent to a rainfall equal to that of the North Coast, with the added advantage that the water is put on the land just when the vines, trees, or crops require it, and the settlers are not dependent upon the uncertainties of the weather.

The Soil.

The land is of mixed quality, that of sandy loam being the best for irrigation purposes. There is a proportion (about one-third) of untimbered land which, so far as it has been tested, has not given good results for fruit-growing, but which, with proper cultivation, will produce good cereal crops. The higher lands, at an elevation of from 50 to 90 feet above the summer level of the river, are uniformly a rich, red, sandy loam, while the river flats are a rich alluvium, fit for crops of all sorts. The Departmental Chemist, reporting on a sample of soil from the area, said: "The soil is a very valuable

one, both from its mechanical condition and its chemical constituents. With water judiciously applied, it should bear good crops of anything, especially fruit of all sorts suitable to the climate; and when showing signs of falling off would easily be renovated by fair dressings of nitrogenous and phosphate manures."

Wentworth Irrigation Area—Vineyard planted in 1908.

The Tenure.

The Wentworth Irrigation Area is Crown land, and is administered by the Minister of Agriculture, under the "Wentworth Irrigation Act, 1902." The blocks are thrown open for selection on what is practically a perpetual leasehold basis. Leases are granted, in the first instance, for a period of thirty years, and the terms are certainly the most liberal ever offered for the combination of so fertile a land, and such a plentiful supply of water.

Wentworth Irrigation Area—Maize Crop.

The rent is calculated at a very low figure, ranging from 2s. 6d. to 5s. per acre, and the water rate at £1 per acre, but with a view to encouraging the industrious man with small means, the full rent and water rate are not asked until the fifth year. For the first year, therefore, the lessee will pay, on an

average, only 4s. 9d. per acre as rent and water rate; 9s. 5d. per acre for the second year; and 14s. 2d. the third year; 18s. 10d. the fourth year; and the full rate for the fifth and succeeding years. No residential conditions are imposed, and the majority of the settlers are men who do not devote their whole time to their blocks, but earn their living shearing, labouring, &c., until their vines and trees are sufficiently advanced to support them and their families, when their whole time will be requisite.

It is owing to the fact that the large number of lessees are men without capital, that the progress of the area has been somewhat slow, the planting having been effected in the time not occupied by them in earning their livelihood.

Preparing the Blocks for Planting.

The average cost of grubbing, burning off, and running out roots, of the timbered land, is £3 per acre, first ploughing, 15s. per acre, grading and making the necessary distributing channels, 25s. per acre, or a total of £5 per acre. In the open country the cost of preparing for planting may be set down at £2 per acre. A five-wire fence would average about £20 per mile, or a three-wire fence and wire netting, £42 per mile. The wire netting is supplied by the Department at cost price, and five years are allowed in which to pay for it.

The cost of planting vines (Gordos) may be set down, approximately, as follows:—

	£	s.	d.	
Price of rooted vines	1	5	0	per acre.
Marking out and planting	1	0	0	,,
Total	£2	5	0	per acre.

Cultivating should not exceed £4 per acre per annum.

The cost of sultanas or currants would be greater than the Gordos after the first year, and in the second year would, approximately, be as follows:—

Trellising, three wires	£5	per acre.
Cultivating and wiring up	4	,,

and the subsequent annual cost for cultivating, say, £4 10s. per acre.

The cost of planting peaches, apricots, nectarines, &c., is estimated to be:—

Trees	£3	per acre.
Marking out and planting	£1	,,
Total	£4	per acre.

The cultivation would cost about £4 per acre per annum.

The expense of putting in citrus trees is greater, as good varieties cost up to £6 per acre, and reckoning eighty trees to the acre, the cost of the plants alone would be about £5. The planting and cultivating would be much the same as for stone fruit.

The following number of vines or trees should be planted per acre:—

Currants and sultanas	280
Gordos	400
Oranges	100
Stone fruit	80

These are the maximum numbers. Planting in equilateral triangles is recommended.

In opening up new land for fruit-growing, a good plan to adopt is to grow a crop for hay the first season; then plough, and allow the land to lie fallow until the next planting season. By this means an immediate return is obtained, and fodder provided for the working horses.

In laying out the subsidiary channels for watering, it is necessary that levels should be carefully taken. On the Wentworth Irrigation Area, the manager, who is a civil engineer and licensed surveyor, supplies levels to those requiring them, thus saving settlers many mistakes and much work.

Wentworth Irrigation Area—Chaff-cutting.

Returns.

Very little return may be expected from any vines until the third year, when the following is a fair estimate:—

Sultanas or currants	... third year ...	£5 to £12 per acre net.	
Do do	... fourth " ...	£12 to £20	"
Do do	... fifth " ...	£25 to £40	"
Gordos	... third " ...	£4 to £6	"
Do	... fourth " ...	£9 to £12	"
Do	... fifth " ...	£12 to £18	"

Vines are in full bearing in the fifth year.

Late Valentias and Washington navel oranges are good paying crops, and at Mildura, a few miles down the river, it is said as much as £100 per acre has been obtained from these in a good year. At Renmark, the South Australian settlement, it is reported that one grower cleared £300 per acre by exporting in the proper season.

Mildura and Renmark.

Settlers from both the Mildura and Renmark irrigation settlements have been attracted to Wentworth by reason of the good soil, plentiful supply of water, and reasonable terms. Mildura is now a township of 4,000

inhabitants. There are 250,000 acres within the irrigation area, of which 5,000 acres are under vines, and 5,000 planted with orchards and citrus fruits. For the year 1903, the value of the products of those 10,000 acres was close upon £125,000, while the value of the land reaches as high as £40 per acre. The charge for water alone is 30s. per acre, as against 20s. at Wentworth, and the land will cost from £5 and £10 and upwards per acre.

The South Australian irrigation settlement of Renmark embraces an area of 4,183 acres, and consists of apricots, 344 acres; peaches, 118; oranges, 202; lemons, 83; muscatel vines, 757; sultanas, 670; currants, 433; olives, 26; pears, 78; nectarines, 4; apples, 4; mixed, 71; and lucerne, 369, with about 1,000 acres unplanted. The value of produce exported from the settlement in 1907 was £78,000.

Markets.

Situated as Wentworth is, a large amount of trade is done with settlers up the Darling River as far as Wilcannia; and there will always be a fair local market for such products as potatoes, onions, green and dried fruits, butter, bacon, &c. As almost the whole of these articles consumed in the town of Wentworth, and up the Darling River to Wilcannia, are imported, there is no reason why the whole of the trade should not be gained by settlers on the Wentworth Irrigation Area.

The main markets will always be the inter-State one which can easily be reached by water carriage, or, *via* Mildura, by rail to Melbourne. In view of the abolition of State duties, this promises to be the principal outlet for the products of the Wentworth district, which, being one of the warm districts of the State, has the advantage of an early ripening of its products, thus giving producers the benefit of the early markets, when high prices rule. For citrus fruits there is always a good State market, more especially for lemons, while dried and pulped fruits are always in fair demand.

Experience of Settlers.

Mr. A. Boyd, a pioneer settler, sold a grape crop on the ground for £32 15s. per ton, the yield being a ton to the acre. Allowing the expenses of picking at £6 10s., stemming and grading 75s., cartage £2, incidental charges 10s., there remained a margin of £20.

A Mildura resident, on visiting the area in 1905, said :—

We stopped to examine the soil in a part where a man was ploughing with a two-horse team. The land had required no clearing, and had not previously been ploughed. It was a fine sight to see it turning up damp, and loose, and friable. I do not know any land in Mildura that I would prefer to it. On 20 acres of land such as this, with the irrigation facilities the area offers, any industrious man, with the requisite experience, ought in a few years to have a comfortable home, and to be in a better position than one with 50,000 unirrigable acres elsewhere in the district.

The following letters have been received from settlers on the area :—

I began work on my lot in May, 1906. It was about half open land, and the rest covered with box timber (about 6 acres), which cost me about £18 to clear. After clearing, I planted about 3 acres of currants in the timbered part, from which I am this year taking a small crop, and, judging by the wonderful growth they have made, they give promise of great results in the near future. Last year I planted about 3 acres of currants and sultanas, all of which are growing with great strides. Twice a year I have

Wentworth Irrigation Area—Currant Vine.

Wentworth Irrigation Area—Raisin Drying

Wentworth Irrigation Area—Gordo Vines.

Wentworth Irrigation Area—Currant Trellising (2 years' growth).

planted potatoes between the rows of vines, and have had good results in most cases, securing first prize two years in succession at Wentworth Show, against exhibits sent from Mildura and other places. Between the vines I also grew maize as a fodder crop with success, most of it reaching to a height of 8 or 9 feet. Pumpkins, water-melons, tomatoes, cabbage, cauliflowers, and French beans have also done well, water-melons reaching as high as 65 lb. in weight. I cropped in 1907 about 3½ acres of the untimbered land, but got rather a poor crop, as the land was uneven, and the water did not get on the higher parts. The same piece of land, planted in June, 1908, yielded nearly 2 tons to the acre; but this time it was cut up by banks into small sections, and watered well and easily. Lucerne grows luxuriantly here, too, as can be judged from the fact that a ¼-acre patch, since coming to maturity, has almost completely fed a draught horse, two cows, and two young heifers.

In 1906 I planted about twenty peach and apple trees, which have made good growth; and this year I had a small crop of early peaches of good quality, which sold locally at 6d. per lb. Of course, I have not yet had any great return from the land; but even so far it has paid working expenses, and promises to return something pretty handsome in a year or two, when the vines are older.

W. C. JOLLEY.

I began working my block of 14 acres 0 roods 22 perches on 1st April, 1906.

My first work was to clear and put in an acre of lucerne, which I found to grow in a most prolific manner, growing to an average height of 3 feet 9 inches; and I reap not less than seven crops a year.

I then planted an acre of currant vines (1906), and they have come into bearing this year (1909), yielding a splendid crop for young vines. I expect to harvest, when dried, about 5 cwt.

In the same year I planted a few Gordos, which are yielding splendidly; also ½-acre of mixed fruit-trees; they, too, are producing very satisfactory. I got as much as a case off some of them. A gentleman from South Australia, now a settler here, told me that the trees and vines are equal in growth to those in South Australia at five years old.

I have also found to grow exceedingly well sorghum, sugar-beet, turnips, mangolds, water-melons, pumpkins, tomatoes, and all kinds of vegetables. I have had pumpkins weighing over 80 lb., and several water-melons weighing between 50 and 60 lb

In 1907 I planted another acre of currants, 2½ acres of sultanas, and 2 acres of orange trees. These, of course, are not yet in bearing, but are growing rapidly.

In 1908 I planted ½ acre of peach-trees with the same results. Also maize was planted, and grows well, averaging from 8 to 10 feet high; and I did see one year on the settlement sorghum 17 feet high.

Speaking generally of the soil on my block, I might say that there are three distinct kinds—sandy, sandy loam, and a stiff clay. On the last-named I grew an excellent crop of wheat and oats, yielding up to 2½ tons to the acre; but I do not think all kinds of fruit-trees would do well on this land (pears, I think, would do well on it), unless treated with fertilisers.

I have not kept any accurate account of my expenditure and returns; but I know the returns have so far been very satisfactory, and when my vines and trees are in full bearing I expect to obtain good financial results.

J. D. JERROM.

A gardener from South Australia, who, with his family, leased three blocks on the area, stated that, up to the time of writing, he had planted 8 acres of vines, containing 1,500 sultanas and 1,200 currants, and 22 acres of trees, namely, 450 apricots, 650 peaches, 250 duchess pears, 700 Washington navel oranges, 23 late Valentias, and 26 mandarins, lemons, &c., and of the whole of the trees and vines planted there were not fifty misses. For value or variety of trees and vines planted, and the quality of the soil, he considered his block to be among the best to be found on the river, either at Renmark or Mildura. He considered the settlement specially well suited for oranges. At a later date he stated that the height of the maize he had grown on his block was quite surprising, and it was intended to send some of the produce for exhibition purposes. He expected to harvest about 200 bushels of maize, and to have a return of £600 for his harvest next year.

Advantages.

The easy terms upon which these blocks are leased, the quality of the soil, and the varied productions which can be successfully raised, make this scheme one under which any man who intends to make a business of irrigation farming can be certain of success. He can establish a comfortable home, and have pleasant and, at the same time, profitable employment both for himself and his family. He will enjoy all the advantages of being in close touch with civilisation, and at the same time have a country life in the open air, while his family, who will have all the facilities for obtaining a good education as they grow up around him, can readily find openings in life on similar lines. One man and his family can do all the work in picking and curing the production from 20 acres of land.

Blocks Available.

The accompanying map shows the portion of the area which has, so far, been subdivided. Those lots coloured red have already been leased. The uncoloured lots, excepting those marked "Reserves," are now available for lease. All details relating to the letting of the blocks, prices, conditions, and regulations can be obtained from the Under Secretary, Department of Agriculture, Sydney, or from the Manager, Wentworth Irrigation Area, Wentworth, N.S.W.

Paspalum and Clover.

In acknowledging the receipt of "Farmers' Bulletin, No. 8," on "Paspalum," Mr. F. V. Wareham of "Koreelah," Byron Bay, relates his experience with this valuable fodder plant grown with clover. He states :—

In the last chapter (page 24) you state that paspalum extirpates every other form of vegetation, whether trefoil, clover, &c. This I find to be the case here, if paspalum be allowed to grow too high. But keep it well eaten down and white Dutch clover and paspalum grow well together, with the exception of about two or three months in summer, when it is too hot here for clover to thrive even without anything to fight. I have known cool damp Decembers here, and during such weather clover springs up, but during steamy, damp hot weather it merely struggles for existence. Paspalum should not be fired if the farmer wishes to grow clover amongst it. I killed out all the clover in a paddock one winter through having cleared up the rough stubble by firing.

If paspalum be eaten down closely during the winter the clover will completely overwhelm it in August and September, after which the struggle will be pretty even for a time, but as the spring advances into summer, the clover has to take a back seat till autumn. I find that these two plants make a fine mixture, and cows always appear to do much better in paspalum paddocks, where there is also plenty of clover.

There is not any question now amongst the farmers here as to the value of this wonderful grass, for it has raised by several hundred per cent. the value of land that was not suitable for other artificial grasses, but which grow paspalum splendidly. I speak of sandy and slaty formations. I have not as yet come across any soil about this district where it will not grow, but, of course, it does best upon rich soil, especially drained swamps.

Hawkesbury Agricultural College and Experiment Farm.

Feeding of Pigs.

[Continued from page 31.]

H. W. POTTS.

XII.

Roots and Tubers.

All roots and tubers, when fed continuously and exclusively to pigs, have a lowering tendency on the digestive functions. This is a matter, however, in intelligent hands, that can be controlled. The value and importance of root crops for pigs, particularly in our warm climate, is now widely recognised, in so far as they are used only as a succulent and relishable adjunct to other classes of food, richer in protein and containing less moisture. A normal nutritive ratio must be maintained, and the success of feeding largely depends on the right interpretation of the balanced ration.

We find many root crops form excellent aids to the standard feeds.

Amongst the domestic animals none respond so readily to root crops as pigs. We have to admit that, under some conditions of climate, they are costly crops to raise, as they require large quantities of water. All things being equal, however, they provide a high percentage of digestible dry matter.

Their value is especially emphasised in making available during the hot, dry months of summer and the cold months of winter a succulent, relishable fodder, when our natural pastures and herbage are dry and scarce.

Seeing they contain high percentages of water, starches, and sugars, it is essential in the maintenance of a maximum growth in fattening swine that they be combined judiciously with cereals, maize, flesh food, lucerne, pollard, skim milk, cowpeas, peas, beans, and other similar foods.

A too wide nutritive ratio may create waste and check good growth, by preventing a complete digestion of the protein, as well as permitting some of the starches to pass from the body as manure.

Potatoes,

When fed to pigs, appear to agree with them better than other root crops, particularly when the ration is balanced with barley, maize, or oats, and skim milk.

The Danes secure very high returns with this class of food. The starchy matter of the potatoes is combined with the protein of the skim milk and cereals to formulate a well-arranged diet. The bacon made from pigs fed on these rations has a notable reputation.

At the Wisconsin Experiment Station it was ascertained that 1 bushel of maize is equal in food value to $4\frac{1}{2}$ bushels of cooked potatoes. In numerous experiments it was found that pigs always secured better flesh gains by being fed on cooked potatoes in comparison with those given raw.

The use of potatoes as a pig feed can only be determined by the current market values. When potatoes are low in price, then their use as a pig food is justified; but where potatoes are grown as a staple crop on the farm there is always an unmarketable residue, and these can be fed to pigs with advantage. Pork raised solely from potatoes has a tendency to be very fat, and wasteful in cooking. In every instance they must be fed with other foods in which the percentage of protein is prominently high.

Artichokes (*Helianthus tuberosus*).

This is a flowering perennial plant which has in the past been overlooked as a valuable food for pigs. It grows from 6 to 9 feet high; and when in bloom, seen from a distance, the crop looks like one of miniature sunflowers.

The stalks are frequently used for feeding sheep or conversion into silage, and the tubers afford a palatable and succulent food for pigs. The plant is very persistent in growth, and, if raised in suitable soil, it is difficult of eradication. Enough tubers, as a rule, are left each year to continue the crop; hence it is wise to set apart a permanent paddock for it, or the odd corners of a farm or waste places of little value for other crops may be used for growing artichokes.

The plant is extremely hardy; it resists frost and drought. Whilst the best crops are raised on good mellow loams, yet profitable yields are secured on stiff clay lands, light sandy or gravelly soils.

The land is best suited where the drainage is good. In fact, any soil suitable for potatoes will answer for artichokes. It is a crop that requires little attention when it is established.

The soil needs thorough cultivation. It should be deeply ploughed about May or June. During the winter it may be harrowed occasionally, lightly reploughed about September, and well manured as if for sweet potatoes. The tubers are then planted by dropping them into furrows 3 feet apart, with a space of 2 feet between each tuber. If the sets are small, plant whole, while large ones may be cut. Cover by turning a furrow over them. About 4 cwt. of tubers will plant an acre.

The crop matures in five months. Should rain fall immediately after planting, the harrow may be run over the land to fine the surface. This should be repeated when the plants are about 4 inches high. This checks evaporation, destroys weeds, and will not injure the crop. Later on the cultivator should be kept moving between the rows about once a month.

When the crop flowers and the tops droop and die, about April or May, it is ready for harvesting. The average yield will be from 7 to 8 tons per acre.

Two varieties have been tested here, and gave the following results:—

Jerusalem White	9 tons 1 cwt. per acre.
Jerusalem Pink	6 „ 16 „

For feeding pigs it is best to turn them into the crop, to root out the tubers. It must be remembered that, where it is desired to continue the crop, the pigs should be removed before all the tubers are eaten.

Few foods are more relished by pigs. The tuber in the raw state is very nutritious, more especially for pregnant sows, and also sows reduced in weight and condition after suckling and weaning big litters.

This class of food acts as a diuretic, or promotes a healthy action of the kidneys in secreting urine; it relieves constipation and stimulates liver functions. One acre will support twenty sows from four to six months.

Young, growing pigs evidence considerable growth on being fed with them for a short period. The exercise obtained in harvesting or rooting up the tubers has a beneficial influence. It is especially notable that artichokes are very digestible.

The outcome of a number of tests go to show that for fattening purposes these tubers must be given with grain, and have a similar result to feeding with ordinary potatoes.

325 lb. wheat, fed with 820 lb. artichokes, gave 100 lb. increase.

The average composition of the artichoke is shown here in contrast with the potato :—

	Water.	Ash.	Protein.	Carbo-hydrates.	Fat.	Nutritive ratio.
Artichoke	79·5	1·0	2·5	16·7	0·2	1 : 7
Potato ...	78·9	1·0	2·1	17·9	0·1	1 : 8·6

Sweet Potato (*Ipomœa Batatas*).

There are two good reasons why this tuber should be grown for pig feed: Its powers of resisting dry conditions are of the highest order; it furnishes a digestible and nourishing food at a time when other succulent fodders are scarce.

During the dry season of 1907, with a rainfall of 13¼ inches, we obtained a crop of 22 tons to the acre. An average crop may be estimated at 10 tons to the acre.

It is this feature of producing a rich food in very dry seasons, when maize, potatoes, and other suitable foods are unable to mature, that the sweet potato differs from other crops, and makes it of such value as a fodder for pigs.

The best returns are obtained when the summers are long.

Moreover, it has the accommodating habit of growing equally well on the coastal areas or the hot, dry plains of the west.

The plant thrives best on a sandy loam; stiff clay lands are unsuitable. It responds to a plentiful supply of organic matter, such as farmyard or green manure. Hence it is wise to plant sweet potatoes after turning in a crop of rape or cowpeas; or it is even good practice to feed off with stock. A rotation of sorghum or maize, cowpeas, and sweet potatoes is satisfactory. The sweet potatoes are thus grown every third year.

The soil should be cultivated deeply. Two ploughings are necessary. The first is carried out in May or June, 8 inches deep, followed by harrowing. Roll and harrow again. Let this remain during the winter, harrowing occasionally, to conserve moisture and keep the land clean.

During the winter the soil becomes firm and compact, with an ample storage of moisture. In spring it is ploughed 4 inches, in order to prepare the surface soil for planting without disturbing the firm, moist, lower soil. In addition to the organic matter already provided by the green crops, or 10 tons of farmyard manure to the acre, the following should be used as a top-dressing per acre :—

2 cwt. superphosphate.
1 ,, sulphate of potash.

The method of raising sweet potato plants is unique. The roots are saved from the previous year's crop, and planted in a hot-bed or cold frame. A bed is excavated about 18 inches in depth, and of sufficient size to accommodate the number of plants to be raised. To propagate enough plants for 1 acre the frame should be 18 feet by 9 feet. Small roots are the best to plant, and this frame will take from 2 to 3 cwt. roots.

One foot of horse manure should be laid in the frame, well moistened with water. Over this spread a layer of sand or light loam 3 inches in depth ; on this place the roots closely, but not touching. Cover with about 3 inches of clean sand.

This operation is conducted about the end of July. The plants should be ready to transplant about the latter part of September or early in October.

In warm districts plants can be raised by placing the roots on a well-worked bed and covered with sand.

During the prevalence of cold weather the young plants should be protected from frosts by a covering of bags.

The bed must be kept moist, but not wet. When the weather is fine and hot the covering of bags should be thrown back during the day.

The small roots intended for raising plants can be kept over winter by storing them in shallow boxes in a cool, dry, dark room. When about 8 inches high the plants are pulled out by hand, leaving the tuber behind. The latter sends up fresh shoots which are available for a second planting.

Those drawn for planting are deposited in a bucket containing a small quantity of water to keep them fresh until planted.

The plants are set in rows 3 feet apart and 2 feet between the plants.

When planting, take care to make the soil thoroughly firm around the roots.

Planting on the flat is generally adopted in order to prevent the loss of moisture. When planted on ridges the evaporation is excessive. Although they will resist considerable hardship, yet it is best to select a cool day. A man and a boy, after a little practice, will find no difficulty in setting out half an acre per day.

When the plants are firmly rooted, the soil between the rows should be stirred with the cultivator, and continued until the leaves meet across the rows.

The harvesting of the tubers is not commenced until the vines begin to die off.

The method of ascertaining when the tuber is mature is by cutting it. If the cut surface dries white and does not develop a dark tinge around the margins it is ripe enough for use.

The tubers have been known to keep in a sound condition underground until August. The flavour is spoiled by severe frosts, but whilst rendered inedible for table use they are quite wholesome for pig food.

Harvesting is usually conducted by hand labour; the vines are cut away with a bill-hook, and the tubers are raised with a fork or tined hoe.

For pigs, the best plan is to hurdle in the crops and allow them to do the harvesting. Both tubers and vines are then consumed, as the pigs relish both; the latter are palatable and very nutritious.

The precautions must be taken to hurdle off a small area at a time, otherwise a larger area would end in a number of tubers being missed and rotted before they could all be eaten.

The varieties subjected to repeated tests at the College experiment plots are—

	tons	cwt.	
Pierson, yield	22	8	per acre.
Pink ,, ...	17	0	,,
White Maltese, yield	14	1	,,
Big Stem Jersey Yellow, yield ...	11	0	,,
Short Stem ,, ,, ,, ...	9	1	,,
Jersey Red, yield	8	11	,,

As with all root crops, sweet potatoes cannot be considered a complete food for fattening pigs. They should be supplemented with good pasture or enough daily supplies of maize, barley, oats, wheat, rye, skim milk, soy beans, cowpeas, lucerne, pollard, or other foods, to maintain vigorous and quick growth.

At the South Carolina Experiment Station, it was found that 32½ lb. of tubers alone produced 1 lb. flesh. The tubers contain a higher proportion of sugar, starch, and fat than the ordinary potato, but they are deficient in protein. The composition is :—

Water.	Ash.	Protein.	Carbo-hydrates.	Fat.
per cent.	per cent.	per cent.	per cent.	per cent.
71·1	1·	1·5	24·7	0·4

And the nutritive ratio is 1 : 17.

Sweet Cassava (*Manihot aipi*).

Although a subtropical plant and a native of tropical America, yet its reputation as a stock food is sufficient to warrant its trial on the northern rivers.

The tubers or underground stems produce large quantities of starch; in appearance they resemble the arrowroot tuber. They run from 2 feet

6 inches to 4 feet long, and weigh as much as 25 lb. each. It possesses a flavour somewhat similar to that of the raw sweet potato. A well-drained friable sandy loam is most suitable for its growth.

Cuttings of the plant stem, 2 feet long, are embedded as if growing sugar-cane. They start shooting within three weeks. Shallow cultivation must be practised until the plants are well-grown. The tubers are fit for raising in eight months. The plant will grow from 4 to 9 feet high. The tubers may be allowed to stay in the soil for eight to ten months if required. The crop yields from 3 to 15 tons of tubers to the acre.

Pigs become very partial to cassava and fatten readily on it. Owing to the great quantity of starch it contains it is necessary to combine crops, &c., of a nitrogenous nature, such as cowpeas, lucerne, soy beans, pollard, or skim milk.

Young pigs and pregnant sows must only be given a limited allowance.

Where pigs are required to fatten quickly, this tuber will afford excellent returns.

The experiments conducted at the Florida Experiment Station afford sufficient evidence to warrant farmers in a suitable climate testing this tuber for feeding pigs.

Parsnips.

These are well relished by pigs and worthy of cultivation.

They require a deep, rich, mellow, and strong loamy soil.

Thorough cultivation is essential. Sow ½ to 1 inch deep in drills, 18 inches apart; 4 to 6 lb. of seed to the acre is required. Thin the plants to stand 3 to 4 inches from each other, and maintain a constant system of shallow cultivation.

They yield from 8 to 15 tons to the acre.

Like other roots they should be fed with grain.

The composition will average—

Water.	Ash.	Protein.	Carbo-hydrates.	Fat.	Nutritive ratio.
88·3	0·7	1·6	11·2	0·2	1 : 7

Mangolds, Mangels, Mangel-wurzel, Cattle Beet, Field Beet.

(*Beta vulgaris*, Linn.)

This root crop is available for pig feed in spring, and is preferred by most farmers for that purpose to turnips. The nutritive ratio is much narrower than other root crops. Moreover, both tops and roots are relished by the pigs. The crop thrives best on good loamy soils well supplied with potash. Fairly good returns are made on moderately stiff clay soils or alluvial flats. Sandy soils are not suitable.

The cultivation must be deep and thorough. Two ploughings are necessary. The first should be 9 inches in depth several months prior to sowing, and the second, 5 inches, immediately before sowing. Moisture must be freely present to effect complete germination.

Sow on ridges about 10 inches high, 2 feet 7 inches to 3 feet apart, at the rate of 7 lb. of seed per acre. Cover the seed 2 inches. Sowing can take place in autumn, about March, or in the spring, about August, while the weather is cool.

The Mammoth Long Red is the best variety. The crop is a gross feeder and exhausts all classes of soil, and thus fresh land should be selected each sowing. The following is the most suitable fertiliser to apply to each acre:—

2 cwt. superphosphate.
1 ,, sulphate of potash.
1 ,, dried blood.

This can be applied when sowing the seed.

The weeds must be kept in check by hoeing. When the plants reach 5 or 6 inches in height they must be thinned out to 8 to 10 inches apart. Careful cultivation should be made with the cultivator, in which much care must be exercised to avoid damaging the roots by disturbing the edges of the ridges. Injury to the roots creates bleeding, and eventually kills the plant.

The crop matures in six or seven months from the time of sowing.

The roots are pulled by hand and the tops trimmed by cutting them off just above the crown. The root must not be cut or damaged, otherwise bleeding sets in, followed by rapid decomposition.

The yield is controlled largely by the character of the soil, rainfall, and treatment. An average crop should return 20 tons per acre.

The following affords some conception of their food constituents as contrasted with sugar beets:—

	Water.	Ash.	Protein.	Carbo-hydrates.	Fat.	Nutritive Ratio.
Mangold	90·9	1·1	1·4	6·4	0·2	1 : 5
Sugar beet... ...	86·5	0·9	1·8	10·7	0·1	1 : 6

Sugar Beets.

From a feeding point of view for pigs, sugar beets are superior to swedes, turnips, or mangolds, although the latter contain more protein. The effect of feeding sugar beets is to improve the quality of the meat. They are entirely digestible, and afford a suitable class of food in dry spells.

Turnips and Swedes.

The cultivation and treatment of these are similar to that accorded to mangolds.

The soil best fitted for a good crop is a rich mellow loam, or an alluvial soil. Light sandy loams are also favourable. Sow the seed at the beginning of March, 2 feet 7 inches apart, in rows on the flat or on ridges. The ridge method is best adapted to stiff or wet soils. Successive sowings can be made until the end of April.

Two to 3 lb. of seed is required per acre. Cover about 2 inches deep.

The weeds must be kept down and moisture conserved by hand hoeing and the use of the cultivator. When the plants are 4 to 5 inches high they should be thinned out to 8 inches apart.

The crop is ready for lifting in from three to four months.

The following yields were obtained at the College farm from different sorts of swedes :—

Skirving's Purple-top Swede	15 tons	16	cwt.	per acre.
Anderson's Imperial Purple-top ...	13 „	3	„	„
East Lothian	13 „	4	„	„
Sutton's Champion Purple-top... ...	10 „	13	„	„
Emperor Green-top	7 „	8	„	„

The best yields of turnips were as follows :—

Yellow Tankard...	10 tons	9	cwt.	per acre.
Green-top Scotch Yellow	7 „	17	„	„
Purple-top Scotch Yellow	7 „	0	„	„

Turnips can be used for pig feed at any time, provided it is supplemented in a similar manner to other root crops.

One precaution must be observed—*i.e.*, not to feed turnips or swedes to pregnant sows, as instances are on record where abortion has been induced possibly by overfeeding on these roots.

Labour-saving Implements.

G. MARKS, Instructor of Agriculture, Hawkesbury Agricultural College.

The McCormick Maize Harvester.

The value of maize and sorghum for feeding purposes is being more fully recognised at the present time than formerly, and in many centres these crops are used extensively for ensilage making. The ease with which they may be grown, combined with the heavy yields obtained, render them admirably suited for cultivating on the small farm. The nature of their growth does not allow of the ordinary mowing-machine being used in harvesting, though many adopt the method of broadcasting, so that by crowding, the plants grow tall and produce fine stems, enabling this machine being utilised. In any case it means an undue strain, as the mower is intended for light, thin-stemmed plants. Most of the maize and sorghum is, however, harvested by hand. Where labour is plentiful no great inconvenience may be experienced, but in many places this is more or less difficult to obtain, which renders the work tedious and expensive. The introduction of suitable machinery has done a great deal towards lessening the cost of production, and the maize harvester will be found of great service to the individual who intends making

ensilage on an extensive scale. Besides, it is of great assistance where a large herd has to be fed daily on the green food. Sufficient material may be cut in a very short time, which would take at least six times as long to do by hand.

The McCormick maize harvester is constructed specially for harvesting any thick-stemmed crops which are grown in drills, and cannot be conveniently handled with the ordinary mower or binder. In the construction of the frame, square tubing and angle steel are freely used, which largely reduce weight without sacrificing its strength.

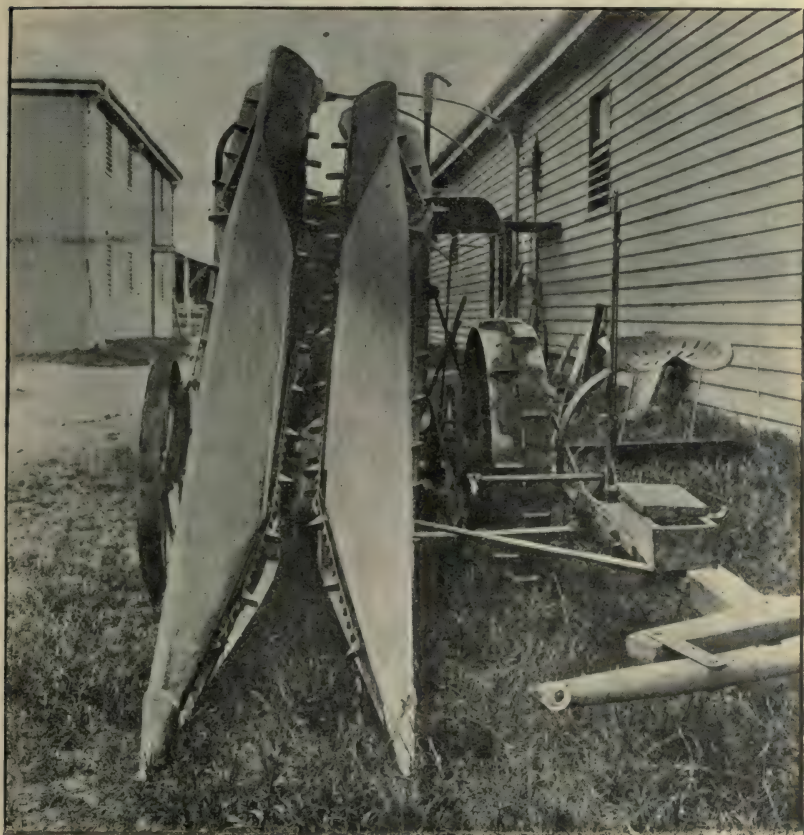


Illustration 1.

Illustration 1 shows a front view of the machine. It cuts and binds one row at a time, the off-side horse walking along the row that is being cut, and it is not affected by the distance the drills are apart, as a pair of dividers guides the stalks to the knives. If necessary, a guard may be attached, to keep any leaning stalks of the adjacent row clear, and thus prevent them from becoming entangled in the elevator chains.

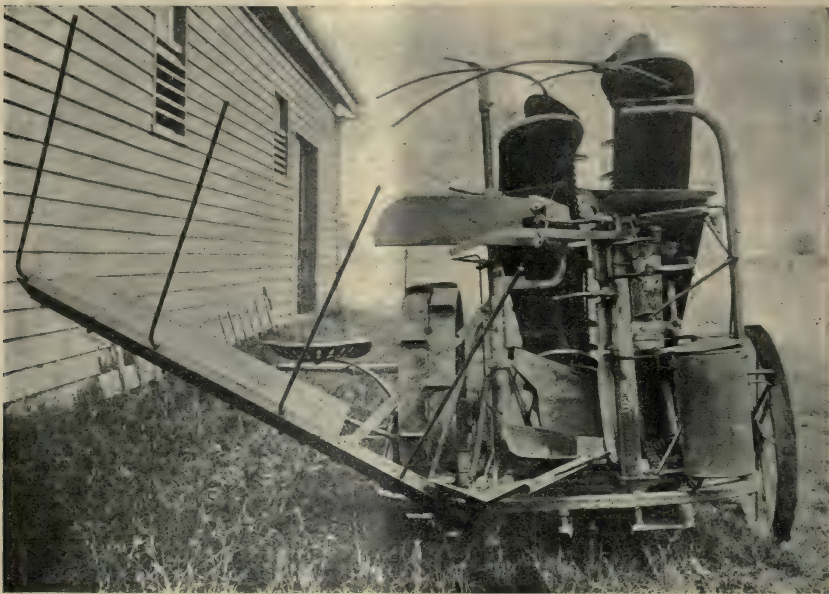


Illustration 2.

Illustration 2.—This gives a rear view, showing on the left the bundle carrier. By this means several bundles may be dropped together, thus saving time in loading. In any average crop, however, this attachment may be removed, as the bundles are quite close enough for convenient handling, and the draught is thereby considerably reduced.

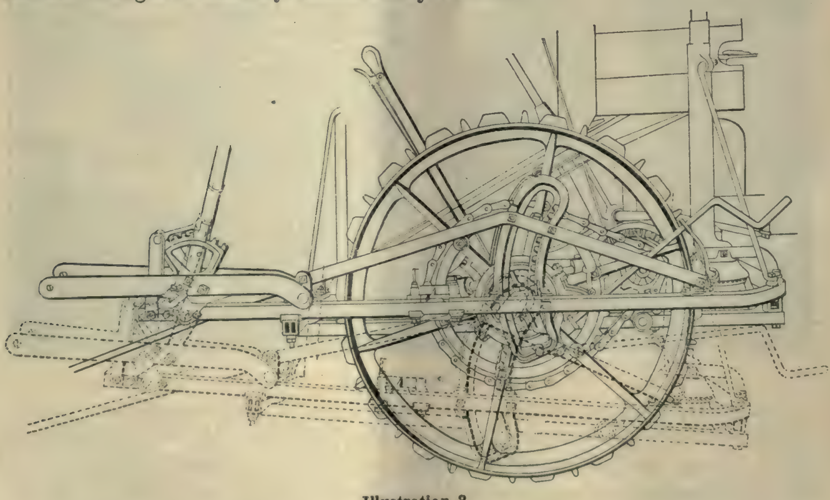


Illustration 3.

Illustration 3 shows how the harvester may be raised or lowered by worm levers. In performing this, it is necessary to keep the frame as level as possible, to prevent any undue side strain on the quadrants. This arrangement enables the stalks to be cut at any desired height.

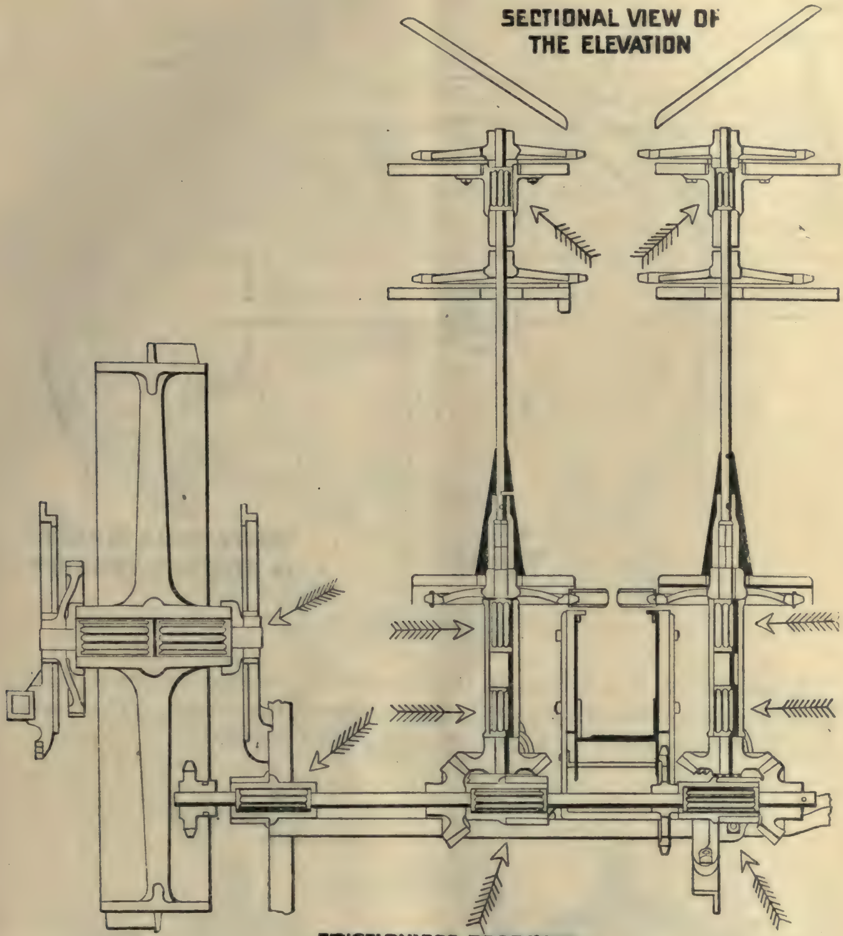


Illustration 4.

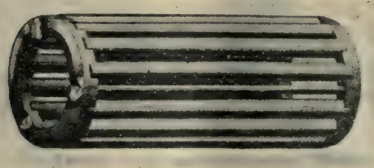


Illustration 4a.

Illustrations 4 *and* 4*a*.—The use of roller-bearings in all the principal parts greatly reduces friction. *Fig.* 4 shows the position of the road wheel and elevator spindles, and where the roller-bearings are used. *Fig.* 4*a* represents one of these bearings.

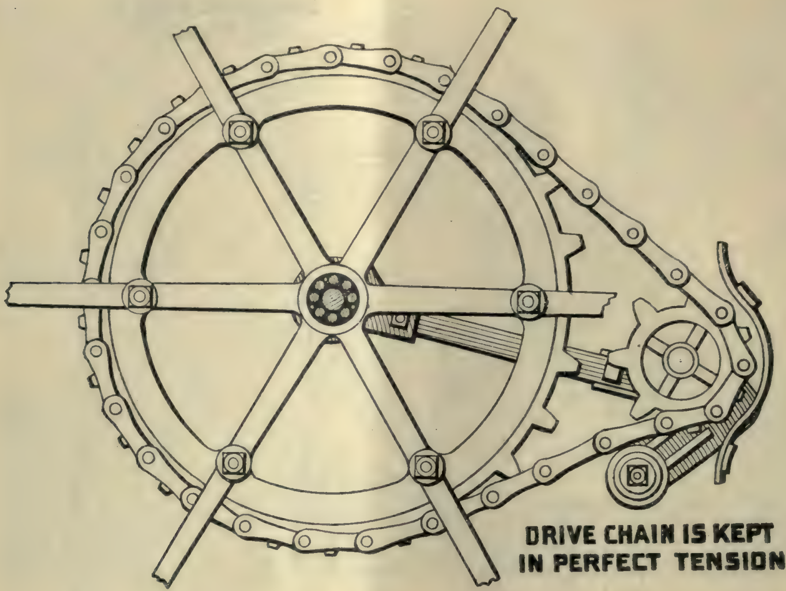


Illustration 5.

Illustration 5 is a section of the road wheel, showing the main driving sprocket, the endless chain belt, and the main driving spindle. The chain is kept in proper tension by means of an adjustable pulley.

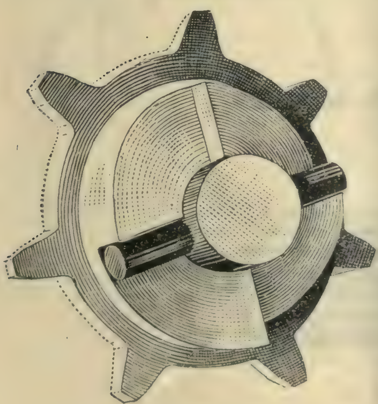


Illustration 6.

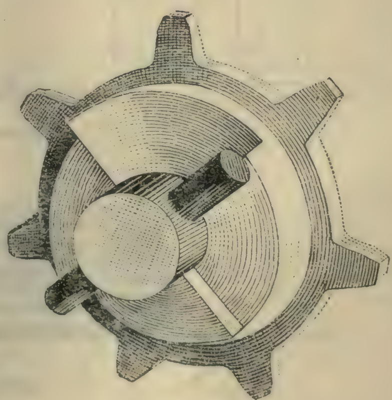


Illustration 6a.

Illustrations 6 *and* 6*a*. –The machine is put in or out of gear by means of a small lever, which works the clutch. *Fig.* 6 shows the clutch in gear,

and *Fig. 6a* the clutch out of gear. It is most important that the clutch is not thrown in gear while the machine is in motion, otherwise the sudden strain may result in breakage.

The pole is attached to the left-hand side of the frame and kept in position by suitable straps. It may be necessary to protect the horses' legs from chafing in turning at the headlands, and this can be done by wrapping some hessian or a chaff-bag round it. A seat is provided for the driver at the side, and all the necessary parts may be regulated from it by a suitable arrangement of the levers. The stalks are cut by means of three knives—two fixed and one sliding.

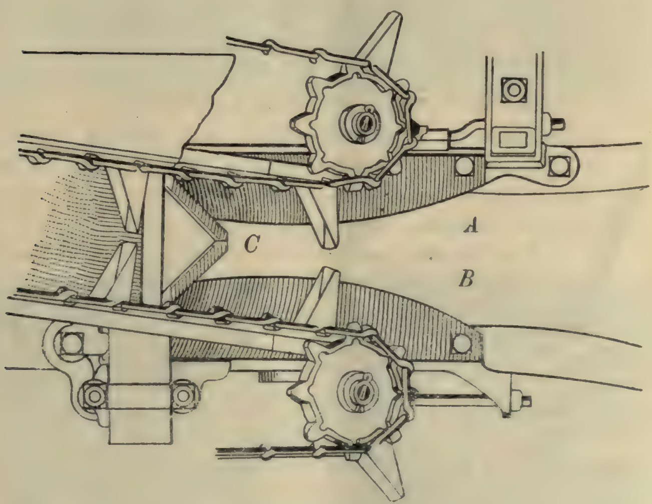


Illustration 7.

Illustration 7 indicates the arrangement of these knives. *A* and *B* are fixed blades, bolted to the frame supporting the dividers, and partly cut the stalks as they pass. *C* is the sliding blade. It is similar in shape to the knife of an ordinary mower, and works by means of a crank movement. The fixed blades take a great deal of strain of cutting from the sliding blade, thus lessening the wear of this part. For good clean cutting it is essential that all three shall be kept sharp and free from gaps that may be caused by coming in contact with hard materials such as sticks, gravel, &c. The lower section of the bottom elevator chains are also shown.

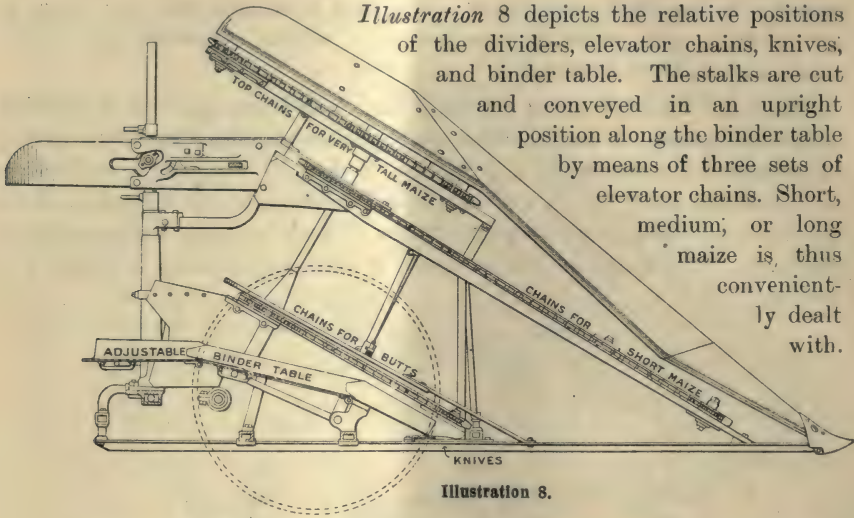


Illustration 8 depicts the relative positions of the dividers, elevator chains, knives, and binder table. The stalks are cut and conveyed in an upright position along the binder table by means of three sets of elevator chains. Short, medium, or long maize is thus conveniently dealt with.

Illustration 8.

Illustration 8a.

Illustration 8*a* is a drawing showing one of the lugs. Adjustments are provided by means of which each pair of chains may be brought closer together for handling a light crop, or set farther apart for a heavier one, while a sliding frame, held by a set screw, maintains them at a uniform tension.

The bundles may be tied at varying distances from the butt to suit the length of the stalks. *Illustration* 9 shows the adjustable binding table. For tall crops, the table is lowered as shown at *B*, but for short ones the platform is raised to *A* by means of the lever *C*, thus enabling the bundles to be tied nearer the butt.

A lever attached to the base of the pole enables the machine to be tilted at any angle. When cutting low, it is occasionally necessary to raise the points of the dividers, so that they and the knives may not come in contact with the ground, when going over any uneven surface.

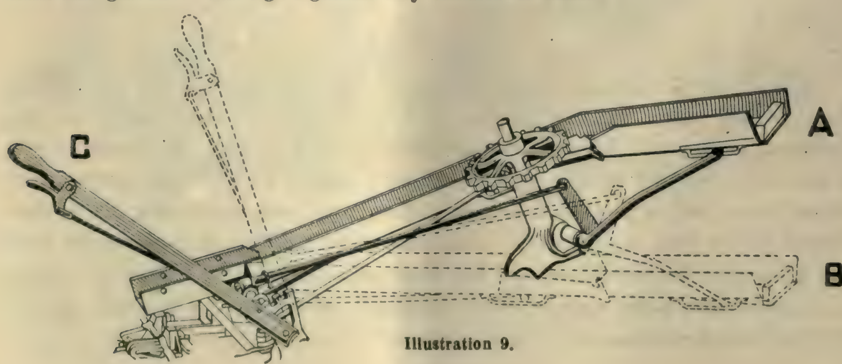


Illustration 9.

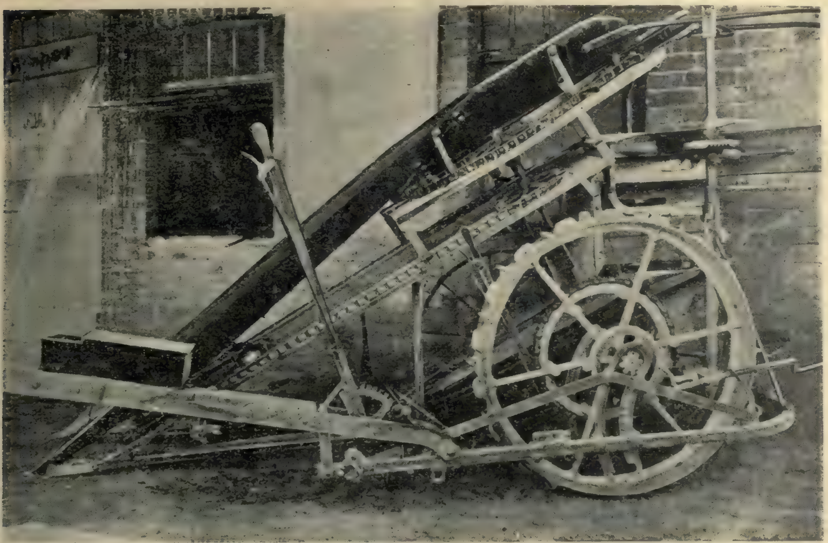


Illustration 10.

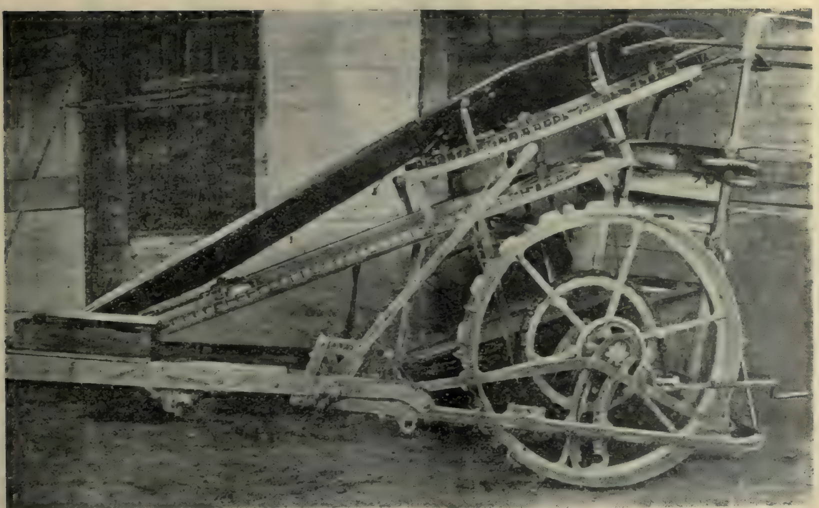


Illustration 11.

In *Illustration* 10 the machine is tilted forward, while *Illustration* 11 shows the dividers raised. In each case the seat has been removed to show the parts more clearly.

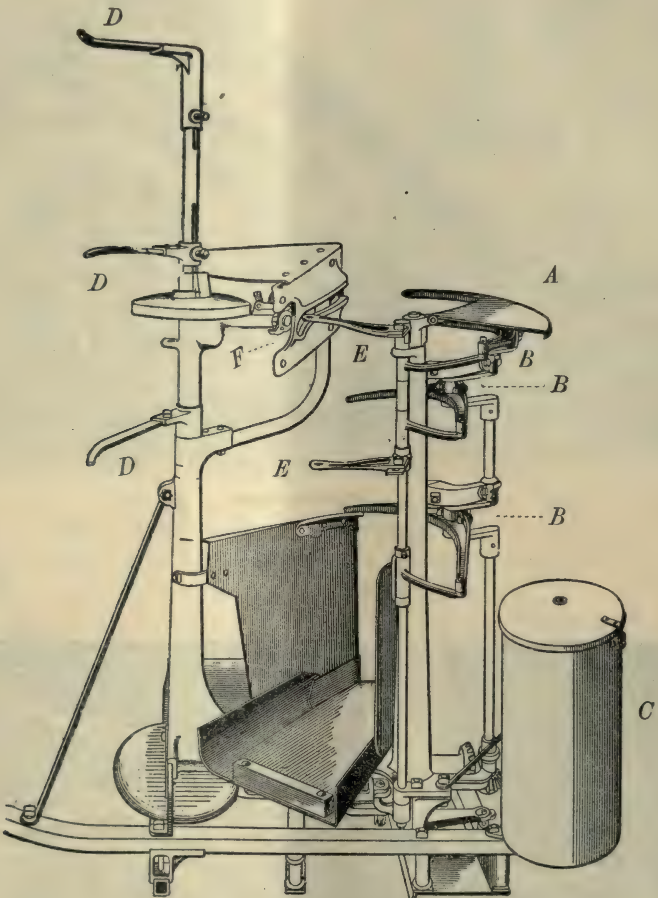


Illustration 12.

Illustration 12 shows the arrangement of the binding apparatus—*A*, needle; *B*, *B*, *B*, packers; *C*, twine box; *D*, *D*, *D*, ejector arms; *E*, *E*, compressor arms; *F*, twine holder and knotter. As the stalks are elevated along the binding table, they are forced against the compressor arms, and when a sufficient pressure is obtained, the trip underneath, controlled by a spring, is released, and the binding apparatus is put in gear. The bundle, when tied, is thrown out by the ejector arms. The size of the bundles may be regulated by altering the position of the compressor arms.

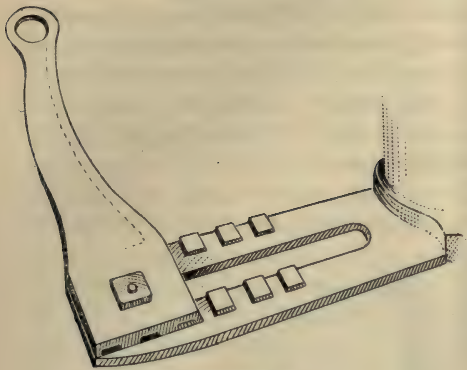


Illustration 13.

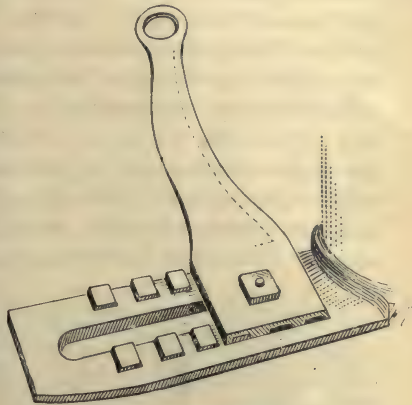


Illustration 14.

Illustration 13 shows the arm set back to make a large bundle; *Illustration* 14, brought forward for a smaller one. It is not advisable to have them too large, especially when the stalks are in any way long, as they become unwieldy in handling.

Illustration 15.

Illustrations 15 and 16 show the harvester at work, using the bundle-carrier, the former a rear view, the latter a side view.

On a cutting basis of 100 acres annually, the life of a harvester may be put down at eight years. At the end of that time the cost of renewing worn parts and bearings becomes so great that it will be found more economical to purchase a new binder. Included with the machine are whippletrees for using either two or three horses. The green feed for an average dairy herd may be cut with two horses; but if a large area is grown for ensilage, and the work is continuous, it is preferable to use three horses, particularly if the weather be very hot. In a day of eight hours, 6 acres may be harvested with two horses, while with an additional horse an extra acre or two may be cut. The cost of harvesting an acre is practically the same whether two

Illustration 16.

or three horses are used, as the cost of the extra animal is more than compensated for by the increased area cut. In estimating the cost, the wages of a man are fixed at 5s. per day, and the cost of a horse at 1s. This latter represents the total cost to a farmer who has good grass paddocks to let his horses run in at night, and produces the whole of the feed consumed on the farm. The amount for depreciation is based upon the cutting of 100 acres a year, averaging from 10 to 15 tons per acre, and a life of eight years.

The cost of harvesting an acre by this machine may be set out at 4s. 3d., made up as follows:—

	Per acre. s.	d.
Man at 5s. a day; 3 horses at 1s. = 3s. } 8s. for 7 acres	1	2
Twine, 3 lb. at 6½d.	1	7½
Oil	0	2½
Renewal of parts	0	3
Depreciation (say)	1	0
	4	3

The parts that require renewing frequently are the connections at end of pitman, knife-guards, knives, and packer-bearings. These involve an expenditure of about 25s. to 30s. a year. The most expensive item is twine, which requires almost as much for binding a 10-ton crop as it does one of 15 tons. At the silo, however, these bands may be saved and used for various purposes, as tying up grape vines, tomato plants, &c.

The cost of cutting an acre of maize and laying the stalks in bundles by hand may be set down at 5s. It takes a good man to do an acre in a day of eight hours. From the foregoing it will be seen that a man with the harvester would cut 7 acres a day, at a cost of £1 9s. 9d., while to do the same area by hand would necessitate the services of seven men, at a cost of £1 15s., a difference in favour of the machine of 5s. 3d. a day. In addition, it must be remembered that a big saving can be effected in loading; ten drays of 25 cwt. each could be loaded in the same time as eight of the loose bundles; and at the silo, where three men are required to handle the former, an additional hand would be necessary to get through the same amount of the latter.

At the time when ensilage is being made, there are usually many other farm operations which demand attention, and it is not easy to spare many hands, while in many places it is impossible to obtain the services of six or seven reliable men for cutting at the time they are wanted.

With prompt renewal of worn parts, proper oiling, and the general care which any machine should receive, the maize harvester will not only economize in the way of labour, but also effect a big saving in time, matters which are of the utmost importance to the man on the land.

The harvester is stocked by the International Harvester Company, and costs £45 in Sydney.

Compound Cake with excessive Sand.

A member of the Royal Agricultural Society of England sent their Consulting Chemist for analysis a sample of compound cake, which he reported on as containing:—

Mineral matter	10·52 per cent.
Including sand	4·96 ,,

He added, "This is an inferior cake, containing a good deal of weed seeds, together with close on 5 per cent. of sand. The cake is made from dirty materials." No further particulars were obtainable.

Champion Dairy Cows.

M. A. O'CALLAGHAN, Chief Dairy Expert.

THE four cows illustrated here will give New South Wales farmers an idea of the standard to which the Americans have reached in the development of the best types of dairy cattle. The Jersey, the Guernsey, the Holstein, and the Ayrshire are represented. Their yields are something phenomenal, but when the Americans go for a championship they generally make things move

Holstein, Colantha Fourth's Johanna.
Champion Dairy Cow of the World.

along, and they certainly have obtained some wonderful records from representative specimens of the different dairy breeds. No doubt in obtaining the yields given, great skill and care have been put forth in the feeding of the individual animals, and it is a pity that instead of giving the record for twelve months we have not the record for a milking period only, showing at the same time the number of days the animals were in milk.

We will first take the Holstein cow, Colantha Fourth's Johanna, as she stands at the top, not only in Holsteins, but it is claimed she has beaten all dairy cows of any breed in the world. Her record for one year, namely, 27,432 lb. of milk, which gave an average test of 3·64 per cent. of butter-fat, or a butter-fat yield of 998¼ lb., is nothing short of phenomenal. She is owned by Mr. W. J. Gillett, of Wisconsin. She is in shape an almost

perfect milking type. Her udder development is great, and her constitution, as evidenced by her well-developed body standing on short legs, is considerably above the ordinary. She has the flat incurving thigh of all great milkers, and the high arched flank, together with very prominent milk veins. Her eye is bright and prominent, and her nostrils large and open, with a strong mouth, all denoting points which are sought for by every dairyman. Her fat test is high for a Holstein, but with selection there is no reason why this great breed should not prove to be up to general standard for fat.

The Guernsey cow, Yeksa Sunbeam, comes next in yield of butter-fat, and she evidently was not photographed when in full milk. The front part of her udder does not appear to be nearly as good as one would expect in a champion, but no doubt it would show up differently if she was at the zenith of her milk-yielding capacity.

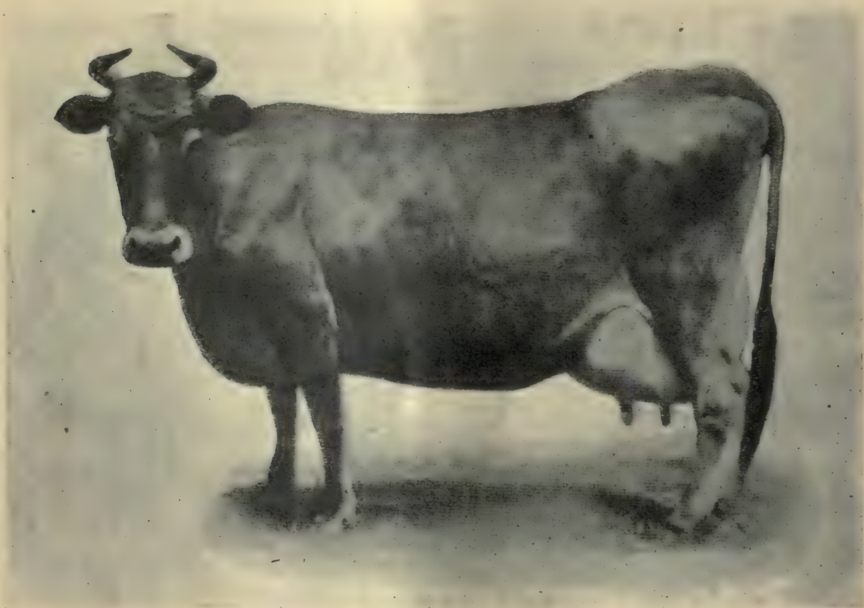
Yeksa Sunbeam.
Champion Guernsey Cow of the World.

She also looks plain owing to having been dehorned, but she is a very typical animal, with plenty of substance and milking conformation. Her mouth is very well developed, and her neck is strong without being coarse. The thigh is very flat, and the flank is arched, though not quite so much as in the Holstein. She is a little high at the setting on of the tail, but this is really a dairy point. Her yield is 14,920 lb. of milk for one year, with an average test of 5·74 per cent. of butter-fat, or a butter-fat yield of 857·15 lb. She is owned by the Rietbrock Estate, Wisconsin, and is the champion Guernsey cow of the world.

The Jersey cow, Jacoba Irene, looks an animal capable of great deeds in the way of milk and butter yields. A wonderfully deep body, with a

well-developed udder. Her nostrils are very large; her mouth is strongly developed; her eye is prominent. She is very high at the setting on of the tail, and this makes her look hollow-backed. Note the very thin flat thigh, the high arched flank, and the great development at the back of the udder, together with the well-placed teats. She is, if not a handsome Jersey from a breeding point of view, at least a very handsome type of dairy cow. Her record is for ten months in 1908, and was 15,503·7 lb. of milk, with an average test of 5·5 per cent. of butter-fat, yielding 853·9 lb. of butter-fat. This animal is owned by Mr. A. O. Auten, Illinois, and is the champion Jersey cow of the world.

The Ayrshire cow, Rena Ross, while not equalling the others in the amount of butter-fat she has yielded, has still put up a record to be envied



Jacoba Irene.
Champion Jersey Cow of the World.

by all breeders. She gave 15,072 lb. of milk, with an average test of 4·26 per cent. of butter-fat, or a total of 643·2 lb. of butter-fat. She is owned by Mr. John R. Valentine, Pennsylvania, and is the champion Ayrshire cow of the world. This animal is of a very vigorous, virile character, representing the old rather than the modern type of Ayrshire. Her horns are of the shape of the Ayrshire of fifty years ago rather than that of the animal we see to-day in our show rings. She looks to be of an extremely active temperament, and is no doubt a very highly-strung animal. She evidences, like all the other champions, a great constitution, without which, of course, it would be impossible for a cow to consume and digest sufficient food to enable her to put up a record anything like that stated. The head and neck

are well placed and shapely but strong ; the barrel is deep ; the flank well arched ; the thigh flat and incurving ; the tail is set on high, but its length is either deficient or its brush has been cut.

I have no doubt the day will come when our New South Wales breeders and dairy-farmers will attempt to do something in the way of advanced dairy records over a lengthened period ; but, before we can approach anything like the results given, we must devote considerably more attention to what is known as hand-feeding, for even during the summer months, when grass is abundant, cows will give an improved yield by the addition of more concentrated foods which help to stimulate them to a higher capacity.

Rena Ross.
Champion Ayrshire Cow of the World.

Jacoba Irene, Champion Jersey Cow of the World.

Records.—Last year—Milk, 14,254 lb. ; average test, 5·6 per cent. ; fat, 798·48 lb. For ten months, 1908—Milk, 15,503·7 lb. ; average test, 5·5 per cent. ; fat, 853·9 lb. Owned by A. O. Auten, Illinois.

Holstein, Colantha Fourth's Johanna, Champion Dairy Cow of the World.

Record for one year.—Milk, 27,432·5 lb. ; average test, 3·64 per cent. ; fat, 998·26 lb. Owned by W. J. Gillett, Wisconsin.

Rena Ross, Champion Ayrshire Cow of the World.

Record for one year.—Milk, 15,072 lb. ; average test, 4·26 per cent. ; fat, 643·2 lb. Owned by John R. Valentine, Pennsylvania.

Yeksa Sunbeam, Champion Guernsey Cow of the World.

Record for one year.—Milk, 14,920·8 lb. ; average test, 5·74 per cent. ; fat, 857·15 lb. Owned by the Rietbrock Estate, Wisconsin.

Diseases of Stock.

Stock Branch. Leaflet No. 3.

Contagious Abortion in Cattle.

Contagious abortion may be defined as an infectious catarrh of the womb, due to a specific organism, and resulting in the premature expulsion of the fœtus. It has been known and feared for many years in all countries in which dairying is carried on to any great extent, such as Great Britain, Denmark, the United States of America, and New Zealand.

It has now been observed in Australia for some years, and is rapidly spreading throughout the coastal dairying districts of this State.

Many investigators have endeavoured to isolate the causal organism of this disease, but so far the most conclusive work has been that carried out by Professor Bang, of Copenhagen, who found between the womb and the fœtal membranes a considerable odourless, gelatinoid exudate, whence he obtained a bacillus which produced abortion in the cow twenty-one days after injection. Other investigators have, however, claimed much the same results for different organisms, and since as yet the causal organism in this State has not been definitely ascertained, the use of anti-abortion serums cannot be recommended, more especially since the disinfectant treatment described below has been found reliable, and may be carried on by the farmer himself at but little expense. In any large herd of cows one or two cases of abortion may be looked for every season, but these are usually due to some obvious external cause, such as overdriving, blows, kicks, death of the fœtus, eating ergotised grasses, or severe constipation, or to some systemic disease such as tuberculosis or pleuro-pneumonia contagiosa. In order to ascertain whether the abortion is present in the contagious form or not the history of the cases should be inquired into. For instance, an in calf cow is bought, and soon after her introduction into a clean herd she aborts, then she shows evidence of oestrum but fails to conceive when put to the bull. Other cows in the herd commence to abort, and in turn fail to conceive. Or, again, a cow from a healthy herd may be sent to a neighbour's bull which has previously served an aborted cow ; this cow either fails to conceive, or later, aborts, and other cows follow in a short while. Or a bull is brought from a herd in which abortions previously occurred, and some time afterwards the cows of the previously sound herd commence to abort. In any of these cases, and in many others in which suspicion of infection can be traced, there is no doubt that it is the contagious form of abortion that is present in the herd. As will be seen from these examples, one of the commonest methods by which the disease is transmitted from cow to cow is by the bull, and this in many cases has caused the bull to be set down as impotent, as a result of which it is sold, and so carries the disease into another herd. But besides this actual transmission of the germ by the bull, cows may become infected

simply by coming in contact with a cow which has recently aborted or with an aborted fœtus, or by being kept in sheds and bails contaminated by the discharges from an infected cow, or even by eating food material contaminated in the same way.

Symptoms.—The first sign noticed by the owner will be that one or more of his pregnant cows abort, or the disease may make its appearance as a form of temporary sterility, the animal taking the bull frequently but failing to conceive. If conception does take place, abortion may be deferred until any time from the third to the seventh month. There may be some heat or enlargement of the udder or a decrease in the milk yield. There is occasionally an opaque whitish-yellow discharge from the vulva. In many cases the abortion is only discovered by finding the fœtus and its membranes. The membranes are, however, often retained and become offensively putrid if not removed. The fœtus is usually born dead.

Treatment.—Once the disease gains a firm hold in a herd, very vigorous measures will be found necessary to stamp it out, and farmers must not be discouraged if they fail to entirely eradicate it in a single season, as it may be as much as two or three years before it is quite got rid of. The measures to be adopted when it has been definitely ascertained that contagious abortion is present in a herd, are the following:—

1. When possible, all cows which abort or show signs of approaching abortion should be isolated—that is, placed in a separate paddock, milked in a detached bail, and not permitted to have contact with the other cows.
2. The sheds and bails should be disinfected with a strong solution of crude carbolic acid or carbolic sheep dip and limewashed, to the limewash being added 5 per cent. carbolic acid or other disinfectant. Limewashing and disinfecting should be repeated every month at least, the bails cleaned out daily, and scrupulous cleanliness enforced at all times.
3. If a cow aborts the fœtus should be carefully looked for, and both it and the membranes burnt, since they are an undoubted source of infection. A fire should also be run over the tainted pastures.
4. All cows which have aborted should be treated as soon as possible after the act has taken place by washing out the womb and vagina with a suitable disinfectant as described below, and washing down the vulva, thighs, the tail (particularly the under part), and back of the udder with disinfectant at the same time. This should be repeated three times at least, with a week's interval between each washing, and the cow preferably kept from the bull for about three months. It is not advisable to wash the cow out within forty-eight hours before being served, as the disinfectant may render the secretions of the bull non-virile.
5. Pregnant cows which have been in contact with others that have aborted should also have the hind parts and the vagina washed with the same solution, but the womb in such cases cannot be washed out, as the introduction of any instrument into it would probably cause abortion. One washing may be sufficient for these cows, but if not found so it may be carried out three times or more as in the case of an aborted cow.

6. In cases in which many cows in a herd are affected, every cow pregnant or empty should be treated at least once.
7. Probably the most important point in connection with this disease is the treatment of the bull. Even though there is only one case in a herd the bull should be treated, for should he serve that cow he will almost certainly transmit the disease to cows which he may serve later. It is always advisable to treat new bulls from unknown herds.

The method of treating the bull is as follows :—The instrument required is an ordinary enema syringe and a disinfectant solution, of which the best are mercuric chloride, 1 in 2,000 ; mercuric iodide, 1 in 5,000 ; or a 1 per cent. solution of kreso or lysol. The solutions used both for bull and cow should be warmed to about body temperature. The bull need not be thrown, but secured against a stout fence, the long hairs at the end of the sheath clipped away and the belly washed with disinfectant. The nozzle of the syringe is then passed up the sheath and about half a pint of solution pumped in. When possible this should be done before and after allowing the bull to serve a cow, and in any case must be repeated every few days.

In washing out the womb of a cow, the instruments required are a large cattle enema syringe or a 3-foot piece of stout rubber tubing about ½ inch in diameter, with an enamel or glass funnel fitted into one end. The disinfectant is the same as that used for the bull. The cow is bailed up, the hind parts washed, and the free end of the tube is then passed into the vagina, and if the cow has been recently pregnant, right through into the womb ; the funnel is then raised and about a quart of disinfectant solution poured in slowly, the free end of the tube being moved about to distribute the flow to all parts of the womb. Care must be taken to boil the funnel and soak the tube in disinfectant before using, to grease the tube with olive oil or benzoated lard, and to wash and disinfect the hands before and after treatment. Probably the handiest solution is the mercuric iodide, if bought in the form of germicidal discs. Four to a whisky bottle full of boiled water will give the required strength. If mercuric chloride is used, only glass, vulcanite, or enamel fittings should be employed, as it corrodes metal.

If it is desired to keep a previously healthy herd free from the disease, no cow should be introduced into the herd without disinfection unless it is known that the herd she comes from is also clean. In the case of pregnant cows, they should be kept isolated if from an unknown source until they have shown themselves clear of the disease by calving at full time. It is generally held that the majority of outbreaks of contagious abortion are blamable either to cattle bought in the open saleyard or to the loaning of bulls between neighbours.

A cow may abort several times, carrying the calf longer each time, and then become immune and carry a calf the full term ; but she may still convey the germ of the disease, and is a source of danger. It is therefore advisable to fatten cows which have repeatedly aborted and sell them to the butcher.

Artificial Incubation.

[Continued from page 195.]

G. BRADSHAW.

Incubators *v.* Hens.

Of the various operations connected with poultry-keeping, hatching is the most important. It is only within recent years that incubation by artificial methods became a practical reality; and while hatching machines are by many considered an essential to poultry-keeping on an extensive scale, at the same time there are many people in this State who are making a living from their poultry alone, and hatch thousands annually, who never had an incubator on their farm.

Some of these breeders are what is known as duck men, and utilise the Muscovy breed for that purpose; but there are others—farmers and market-men—who eschew the machines, for the simple reason that they believe the hen is the safer and better hatcher.

The same can be said of American poultry-keepers, for, despite the fact that there are more incubators used in that country than in all others combined, some of the leading breeders still retain the hen for hatching and rearing, claiming that where quality has to be considered nothing can beat the natural mother. One of the leading Plymouth Rock breeders in that country, not long since, stated that he would never trust his best eggs to the vagaries of a kerosene lamp, and right through the States the agriculturists, although nearly all poultry-keepers, are chary of artificial methods.

In England numbers of the leading fanciers, and thousands of the Surrey and Sussex market poultrymen, will have nothing to do with the wooden hen, and it is well-known that the best table poultry in the world is produced in these counties.

A hen can be set in almost any place. She may come off the nest, and remain off a few minutes or an hour, and goes back, possibly wet and cold. She may turn the eggs with her beak several times a day, or, as far as can be seen, not turn them at all, and if the eggs are fertile and she a careful hen, a chick for every egg may result, and with even ordinary food will probably rear the entire flock. Is it any wonder the hen still retains a large patronage?

Despite the above, the incubator is each year coming into more general use, and there is scarcely a doubt but that in the near future the hatching machines will be a necessary adjunct to every moderate-sized poultry farm, for the simple reason that more money can be made with than without them.

Early chickens are always the most profitable for those who breed for the market. The early shows also demand early hatching by the fancier. The chief trouble to this end is the scarcity of broody hens in the spring months, and many a setting of good eggs has been lost through the owner's inability to secure broodies.

The advantages of artificial methods are—the incubator is always ready, summer and winter. As soon as the eggs are ready so is the machine, there being no waiting. Chickens can be hatched in much greater numbers and with less attention than by hens. In the summer season, unless the greatest precautions are taken, sitting hens become infested with vermin, and not infrequently these pests are responsible for the hen deserting her nest; but even if she is kept comparatively clean and hatches her brood, the infestations leave her and go for the more tender host, the newly hatched chickens. Thousands of deaths occur each returning season from the louse, the mite, or other vermin acquired from the mother hen; and what does it benefit a man if he hatch all his eggs, and through this cause lose all his chickens? Incubator-hatched chickens start life free from vermin, and, with but moderate attention, will continue free throughout the rearing period.

Again, while the small breeder and fanciers will find greater profits from early hatched birds, necessitating the use of a machine, the large breeder, who makes his entire living from fowls, will benefit still more by the artificial methods, from the fact that large numbers must be hatched and reared to bring in sufficient income; and to secure, say, 500 pullets to lay in the best months for eggs—March, April, and May—one thousand chickens would have to be hatched, as the approximate half of them would be cockerels; and to secure that number, over one hundred broodies would be required—a number which it would be impossible to secure on any farm in the spring months.

Two hatches of two 250 egg-machines would be quite equal to the above. Even were the requisite number of broodies available, there is all the trouble of seeing to them in the way of feed, coming off and going back to the nests, keeping them free from vermin, and attending to them during hatching-time, cooping the hen and chickens, and a lot of other labour, which only those who have had experience realise.

The machines, on the other hand, entails only the labour of replenishing the lamp regularly, and the turning of the eggs morning and night. There is the further handicap that all the hens would have to be fed during the three weeks of hatching, and for the six or eight weeks when rearing the chickens.

By using the incubator these hens would have a rest, and start laying in a short time. Briefly, the incubator is ready to hatch every day in the year; there are no broken eggs to soil the remaining ones; the chickens are not trampled on during and after hatching; they arrive in the world and continue free from vermin; the chickens can be reared in larger numbers, and with less labour than with the hen. The breeder, whether on a large or small scale, will make more money by using artificial methods in hatching chickens.

The Practicability of Incubators.

Reference has already been made to the large variety of incubating machines put on the market within the past twenty or thirty years. Every one of the different makes hatched chickens, but, through expensiveness, a too small percentage of results, a too limited capital of the builder to put them on the market, or other causes, a large number of them had but a brief

existence. Those illustrated, whether foreign or Australian made, are incubators that have stood the test of public opinion, not through occasional instances of hatching 100 per cent. of fertile eggs, but through the general average results; and taking one season with another, and the varied climatic changes, the most exacting operator is satisfied with 70 or 80 per cent., an average which is scarcely attained by hens. At a Poultry Conference, held at Ontario College last year, where many of the incubator manufacturers attended, Mr. C. Cyphers read a paper, wherein he stated that 77 per cent. was not a large one for an incubator, adding: "I could take 400 eggs, and give 200 to an incubator ard 200 to the hens, and would guarantee to get as good results from the incubator." Each of the machines mentioned has at times hatched every fertile egg, and that they have all given results as low as 50 per cent. is proof enough that the fault was either with the fertility or vitality of the eggs, a faulty thermometer, the machine in an unsuitable building, excess or lack of moisture, ventilation, or heat, or a score of other things, the simple fact obtaining, that if fifty eggs produce the same number of chicks in one hatch, under exactly similar conditions, there would be the same results on every occasion. Mr. Cyphers, in the paper mentioned above, remarks:—

There is a difference in the handling of incubators. I can give you the experience I had on a large poultry farm, where they were using 100 of my machines. There were two operators, one taking care of the machines in one half of the room and the other the other half. The eggs were divided up each day as they were gathered, and one operator averaged over 78 per cent. of all the eggs set during that season, while the other brought off something like 67 per cent. I visited the plant several times during the season until I finally located the trouble. The machines taken care of by the lad who was not getting the best results were not as nicely regulated as they were on the other side of the room, and the difference in the temperature showed that he had not tested up carefully and taken the necessary pains to keep the thermometer on a fertile egg. The machines were given to a man who looked after these points more carefully, and the hatches improved.

One thing may be remarked: the average hatches here are higher than in America, and probably due to our more equable climatic conditions in the spring; and that they do not show still better results is due to one or other of the causes which follow.

Causes of Failures.

It needs no gainsaying that to have chickens we must first get the eggs, and fertile ones at that; and even being fertile, and the heat and other elements correct for hatching, chicks from several causes may not result. The eggs may be of weak fertility. The germs quicken into life and die at any stage in the hatching period, but usually from the tenth or twelfth day. Should they get over this period and fail to hatch, the death generally takes place about the twentieth day, and is then known as "dead in shell," and frequently is due to some unsuitable element—heat, moisture, or ventilation; or the vitality may be all right and the chicken still remain an unhatched one through an over-thick shell on the egg. The chick in this instance would have successfully emerged from a normal egg, but is, although strong, unable to break the shell and dies in the attempt.

There are several causes for weak germs, and they are generally associated with infertility—that is, if 40 or 50 per cent. of the eggs put under a hen,

or in an incubator, are infertile, the fertile ones will have a much larger percentage of both weak germs and dead in shell than when 80 or 90 per cent. of the eggs were fertile. Weak germs and infertility are but seldom found in the small breeders' yard, and rarely on the agricultural farm, but are of common occurrence where hundreds or thousands of fowls are kept. On the agricultural farms fowls have usually a large range and kept under natural conditions, having free access to weeds, seeds, and the great essential, animal food, in the shape of insects of varied sorts. Under such conditions, a healthy male bird of the Leghorn breed will fertilise the eggs of from a dozen to twenty hens; and if, say, sixteen eggs are got daily from these twenty hens, and one or two infertile ones result from each day's laying, the fault is not that there were too many hens, but rather that the male bird has his likes and dislikes—there being some hens in every flock which the rooster has an aversion to, and these never lay a fertile egg. This feature will be best realised in a small pen of fowls when two or three of the hens may be seen with the feathers torn off the back by the attention of the male bird, and perhaps one hen with not a single feather out of place.

Under the free range conditions, an Orpington or a Wyandotte bird will usually fertilise the eggs of a dozen or more hens, provided he has no aversions, and each of these eggs will produce a chicken under the usual three weeks' treatment by either hen or kerosene.

The owner of the plant where thousands are kept has vastly different results. The operations of many of them are chiefly for eggs, and the feeding which gives the best results to that end is rarely conducive to fertility, nor can the owners continually examine the thousands of fowls as to their apparent health. Several may be in poor condition, others too fat to give good hatching results. Then some of the roosters may be much inbred, anæmic, or in a generally poor condition, unknown to the owner, which would account for both infertility and weak fertility.

There are several other factors on the big poultry-farms here or abroad which are responsible for the fact that from two to two and a half eggs are required to produce one chicken, whether under a hen or in the incubator.

Reports of many experiments could be supplied, largely from American stations where the object was to determine the question of low hatchings, and in almost every instance where results were unsatisfactory, *i.e.*, dead germs and dead in shell, they were associated with a large percentage of infertility.

The following local experiment can be quoted in support. In 1901, a public incubator competition was held at the farm of Mr. S. Ellis, Botany. There were three rounds of hatches, hen eggs, English duck eggs, and Muscovies. The eggs were all from Mr. Ellis's large farm.

The following report of the three hatches is taken from the *Daily Telegraph*, which had arranged the competition:—

> Three months have been occupied in completing the incubator competition organised by the *Daily Telegraph*, and conducted by Mr. Samuel Ellis. The percentage of hatchings has not been altogether satisfactory, but this has been almost entirely due to the low average vitality of the eggs. The management proved all that could be desired.

In the case of the Petaluma, it is a self-evident fact that the individual machine used was at fault. The Nonpareil secured two of the best hatches out of the three, and leads by a fraction, but there is practically nothing to choose between its record and that of the Zenith.

Messrs. G. Bradshaw (judge) and S. Ellis report of the third contest with Muscovy duck eggs, which commenced on November 6 :—

Incubator.	Infertile.	Bad.	Good.	Hatched.	Per cent.
Nonpareil	7	31	62	37	59¾
Zenith	8	23	69	33	47¾
Golden Cob	19	27	54	19	35
Cyphers	12	37	51	14	27½
Egyptian	13	26	61	12	19¾
Eclipse	13	21	66	5	7½
Petaluma	15	36	49	0	0

Mr. Ellis, while working machines according to makers' instructions, believes that had he been allowed to use his own judgment, some of them would have given better results.

The comparative aggregate results of the three tests are shown in the following table. The number of fertile eggs (including those bad when tested) are shown, together with the hatchings and percentage. The total consumption of oil is also given, and in this connection it should be remembered that the Golden Cob, Cyphers, and Petaluma are hot-air machines :—

Incubator.	Fertile eggs.	Hatched.	Percentage.	Oil consumed.
				Quarts.
Nonpareil	260	158	60·76	15½
Zenith	265	160	60·37	15⅛
Golden Cob	248	130	52·41	38
Cyphers	246	118	47·98	31
Eclipse	247	106	42·91	9¼
Egyptian	247	105	42·51	12½
Petaluma	229	36	15·72	29½

It will be seen there was a large percentage of infertile eggs, a very large percentage of dead germs, *i.e.*, those described as bad, the total hatching being a miserably small one, and this from machines all of which have before and since, from different eggs, given 80 to 90 per cent., and occasionally higher, the Hawkesbury, Gatton, and Roseworthy Colleges all reporting up to 93 or more chickens from 100 fertile eggs.

One other handicap to successful hatching is abnormally thick-shelled eggs. There is a small portion of shell forming material in all food, and when grit is about the hens pick up sufficient to complete the covering of each egg, but occasional hens have organs which secrete a larger quantity of shell material than is actually necessary, resulting in the carbonaceous covering of the egg being too thick for the ordinary chicken to break, thus accounting for a number of the dead in shell, irrespective of whether the egg was under a hen or in an incubator.

One illustration of this came under notice the present season. Two settings of white Leghorn eggs were purchased from a breeder, which were placed under two hens. One hatched out eleven chickens and one dead in shell; the other hatched ten, and two dead. The three eggs which failed to produce live chickens were examined and found to be not only abnormally thick in shell, but the further fact that their shape and general appearance were convincing that they were all laid by the same hen.

Eleven and ten chickens were considered excellent hatches; still, had 100 of these eggs been put in an incubator, and the same proportion of this particular hen's eggs been among them, there would have been the big percentage of 13 from this cause which failed to hatch, and, as usual, ventilation, moisture, &c., advanced as to the cause, the actual facts being that, notwithstanding strong fertility, and all other elements correct, the walls were too strong for the prisoner to break through.

Eggs too thin in shell, malformed eggs, the season of the year when laid, the feeding of stock birds, the operator, and a score of other causes, may one or the other contribute to the incubating failures.

(To be continued.)

Agricultural Bursaries.

In connection with the improved scheme of agricultural education, arrangements are now being made for the granting of annual bursaries to the Hawkesbury Agricultural College, the Wagga Experiment Farm, or the Bathurst Experiment Farm. When accommodation shall have been provided at Wollongbar Farm one bursary will be granted to the School Farm there.

The Regulations governing the granting of these bursaries are as follows:—

1. Three bursaries each will be given to the Hawkesbury Agricultural College, Wagga and Bathurst Experiment Farms.

2. Each bursary will provide free board, lodging, and education, but all incidental expenses for books, medical, and dispensing fees, chemicals, sports, &c., must be met by the bursar.

3. Bursaries will be awarded after competitive examination. Such examination will not be so much academic as designed to test fitness for agricultural education, special attention being given to aptitude and requirements for future career.

4. Applications for bursaries must be on the forms provided for the purpose. Parents or guardians must produce satisfactory proof to the Minister that they are unable to pay the usual fees, and that the applicant could not get the required education without the aid of a bursary.

5. Candidates for bursaries must be over the age of fifteen years, and not older than nineteen years.

6. Other things being equal, preference will be given to the sons of men engaged in rural occupations, and as far as practicable the bursaries will be evenly distributed over the State, each being made available at the school best suited to the student's past experience and future requirements.

7. It must be distinctly understood that the accommodation and fare provided at the Farm Schools will be simple, and adapted to the student's future career as a worker. The main purpose of the education will be to turn out practical farmers.

8. Any bursar who is idle, inattentive, or unsatisfactory in conduct or progress, will be liable to immediate dismissal by the manager. Bursars must conform to, and obey the rules and regulations for the time being in force for the government and management of the college or farm to which he may be sent.

9. Bursaries will be renewed only upon passing any prescribed term examinations, and on gaining a satisfactory report on the year's work and conduct from the principal or manager.

The first bursaries will be available for the 1910 session.

LEPTOCHLOA DECIPIENS, STAPF.

ORIGINAL, DRAWN FOR THE AGRICULTURAL GAZETTE.

Useful Australian Plants.

J. H. MAIDEN,
Government Botanist and Director, Botanic Gardens, Sydney.

No. 102. *Leptochloa decipiens*, Stapf.

Botanical Name.—*Leptochloa*, Greek, *leptos*, slender, *chloe*, grass; *decipiens*, Latin, deceptive, in allusion to the fact that it is apt to be confused with other grasses.

Description of Genus.—Leptochloa (B.Fl. vii, 616).

> *Spikelets* several-flowered, or rarely one-flowered, sessile in two rows along one side of the slender usually numerous branches of a simple panicle, the rhachis of the spikelet articulate above the outer glumes and more or less produced above the flowering ones.
>
> *Glumes* keeled, acute or obtuse, unawned, the two outer empty ones shorter or rarely as long as the flowering ones.
>
> *Palea* prominently two-nerved or folded.
>
> *Grain* smooth or nearly so, the pericarp very thin and adnate.

Key to Australian Species:—

Spikelets several-flowered; flowering glumes rather obtuse.
Spikes crowded at the rhachis ... ... 1. *L. subdigitata*
Spikes scattered along the slender rhachis ... 2. *L. decipiens*.
Spikelets one-flowered, flowering glumes acute ... 3. *L. polystachya*.

(No. 3 is not found in New South Wales.)

I have tried in vain to find a satisfactory distinction between the genera *Eragrostis* and *Leptochloa*. The former belongs to the *Festucaceæ* and the latter to the *Chlorideæ*. The only constant difference between the genera is that *Leptochloa* has sessile spikelets and *Eragrostis* pedicillate spikelets. This difference is given in Bentham's "Flora Australiensis," in Hooker and Bentham's "Genera Plantarum," and in Hackel's "True Grasses." The most confusing thing is that according to this character all our specimens of *Leptochloa decipiens* are *Eragrostis*, since all spikelets are distinctly pedicillate.

Note re description of species.—Dr. Stapf, of Kew, the well-known authority on grasses, with whom (through Colonel Prain) I have been in correspondence concerning this grass for a considerable time, states that he is of opinion that it is distinct. Dr. Stapf's description has not yet come to hand, but, with the key I have already given, and the plate, it is impossible to confuse the grass with its congeners.

Robert Brown described two North Queensland forms, merged in this species, in the following way:—

> *Poa decipiens*, paniculâ nutanti: ramis alternis simplicibus flexuosis spicatis, spiculis 2-3 floris, perianthii valvulâ exteriore dorso glabro marginibus sericeis apice obtuso: interiore ciliatâ foliis angusto-linearibus vaginisque scabris: ligulâ incisâ. (*Prodromus*, p. 181.)

Poa imbecilla, paniculâ subnutante: ramis alternis simplicibus spicatis, spiculis distinctis 3–5 floris, perianthii valvulâ exteriore obtusâ dorso glabro marginibus interiorisque nervis ciliaris, foliis involutis vaginisque glabris: ligulâ erosâ, culmo capillari. (*Ib.*, p. 181.)

Synonyms.—This is a grass which has a most puzzling synonymy, which I will endeavour to clear up. The true *L. chinensis* does not appear to have been found in New South Wales.

Its synonyms are:—

1. *Poa decipiens*, R. Br. *Prod.* 181.
2. *Poa chinensis*, Kœn.
3. *Leptochloa tenerrima*, Rœm. et Schult.
4. *Eragrostis decipiens*, Steud.
5. *Leptochloa chinensis*, Nees, the name adopted by Bentham in the "Flora Australiensis" for our grass.
6. *Eleusine chinensis*, F. v. M., the name adopted by Mueller in the Census.
7. *Poa imbecilla*, R. Br. *Prod.*
8. *Poa asthenes*, Rœm. et Schult.
9. *Eragrostis imbecilla*, Steud.

The genus is *Leptochloa*, and Dr. Stapf, of Kew, in a letter to me, looks upon it as a distinct species, as I have already stated. Nos. 1–6 are really the names of an Indo-Malayan grass (except No. 6, which is probably the plant now figured), and he proposes the name *L. decipiens* for it.

Nos. 7–9 are synonyms of a slenderer grass henceforth to be known as *Leptochloa decipiens.*

Value as a fodder.—We know little or nothing of the fodder value of this grass. Its identity has hitherto been almost hopelessly confused, and hence no data have any value except actually accompanied by a specimen of the grass in question. Following is such a note:—

I collected it in Peach Tree Gully, East Cunderang, east slopes of New England. This grass is a rare species, grows in narrow gullies and on the shady side of the range (south) chiefly, and under rocks in localities mentioned. The soil is usually moist; height, 2 up to 2½ feet; is, I think, perennial, as old withered stems almost decayed, and others with ripe seeds, and other stems beginning to shoot forth, may be seen on the plant at the same time. It is a tufty upright growing species; it grows freely under timber. Cannot speak as to its value as a pasture grass. Have seen this or a nearly allied grass on the cuttings on Armidale–Kempsey road, as far down as East Urulgurra, 30 miles from Kempsey.—(A. R. Crawford, Moona Plains, Walcha.)

I shall be very grateful if observers will look out for this grass and favour me with notes on its value to stock.

Range.—Following are the localities of specimens in the National Herbarium, Sydney:—

New South Wales.—East of Cunderang (A. R. Crawford); George's Creek, near Macleay River (J. L. Boorman); Kelly's Gully, Warialda. "A tall robust grass of 3–4 feet high, forming a large stool of a foot or more in diameter, growing in river-beds."—(J. L. Boorman.)

Queensland.—Rockhampton (P. A. O'Shanesy; R. Simmons, Nos. 6 and 25).

Then we have the localities quoted by Bentham in the "Flora Australiensis." Its range may therefore be defined as east central New South Wales and also Eastern Queensland from New South Wales to the tropics. Now that the grass has been identified it will probably be found to be very common.

EXPLANATION OF PLATE.

1. Entire plant, natural size.
2. A single spikelet with part of the panicle—branch, much enlarged.
3. The same spikelet opened out.
4. A flowering glume with palea and grain.
5. (*a*) Outer glume.
   (*b*) Second empty glume.
   (*c*) One of the flowering glumes, with
      (*d*) Palea.
      (*e*) Grain.
   (Nos. 1-5 drawn from an East Cunderang, N.S.W., specimen.)
6. A spikelet from Rockhampton, Q., with more numerous flowers.

"The Agricultural Gazette."

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Reinforced Concrete Fence Posts

(*United States Farmers' Bulletin, No.* 235.)

THERE is a constantly increasing demand for some form of fence post that is not subject to decay. The life of wooden posts is very limited, and the scarcity of suitable timber in many localities has made it imperative to find a substitute. A fence post, to prove thoroughly satisfactory, must fulfil three conditions: 1. It must be obtainable at a reasonable cost. 2. It must possess sufficient strength to meet the demands of general farm use. 3. It must not be subject to decay, and must be able to withstand successfully the effects of water, frost, and fire. Although iron posts of various designs are frequently used for ornamental purpose, their adoption for general farm use is prohibited by their excessive cost. Then, too, iron posts exposed to the weather are subject to corrosion, to prevent which necessitates repainting from time to time, and this item will entail considerable expense in cases where a large number of posts are to be used. At the present time, the material which seems most nearly to meet these requirements is reinforced concrete. The idea of constructing fence posts of concrete reinforced with iron or steel is by no means a new one; but, on the contrary, such posts have been experimented with for years, and a great number of patents have been issued covering many of the possible forms of reinforcement. It is frequently stated that a reinforced concrete post can be made and put in the ground for the same price as a wooden post. Of course, this will depend, in any locality, upon the relative value of wood and the various materials which go to make up the concrete post; but, in the great majority of cases, wood will prove the cheaper material with regard to first cost. On the other hand, a concrete post will last indefinitely, its strength increasing with age, whereas the wooden post must be replaced at short intervals, probably making it more expensive in the long run.

In regard to strength, it must be borne in mind that it is not practicable to make concrete fence posts as strong as wooden posts of the same size; but since wooden posts, as a rule, are many times stronger than is necessary, this difference in strength should not condemn the use of reinforced concrete for this purpose. Moreover, strength in many cases is of little importance, the fence being used only as a dividing line, and in such cases, small concrete posts provide ample strength, and present a very uniform and neat appearance. In any case, to enable concrete posts to withstand the loads they are called upon to carry, sufficient strength may be secured by means of reinforcement, and where great strength is required, this may be obtained by using a larger post with a greater proportion of metal, and well braced, as is usual in such cases. In point of durability, concrete is unsurpassed by any

material of construction. It offers a perfect protection to the metal reinforcement and is not itself affected by exposure, so that a post constructed of concrete reinforced with steel will last indefinitely, and require no attention in the way of repairs.

Reinforcement.

No form of wooden reinforcement, either on the surface or within the post, can be recommended. If on the surface the wood will soon decay, and if a wooden core is used, it will, in all probability, swell by the absorption of moisture and crack the post. The use of galvanized wire is sometimes advocated, but if the post is properly constructed, and good concrete used, this precaution against rust will be unnecessary, since it has been fully demonstrated by repeated tests that concrete protects steel perfectly against rust. If plain, smooth wire or rods are used for reinforcement they should be bent over at the ends, or looped to prevent slipping in the concrete. Twisted fence wire may usually be obtained at a reasonable cost, and it is very well suited for this purpose. Barbed wire has been proposed and is sometimes used, although the barbs make it extremely difficult to handle. For the sake of economy the smallest amount of metal consistent with the desired strength must be used, and this requirement makes it necessary to place the reinforcement near the surface, where its strength is utilised to greatest advantage, with only enough concrete on the outside to form a protective covering. A reinforcing member in each corner of the post is probably the most efficient arrangement.

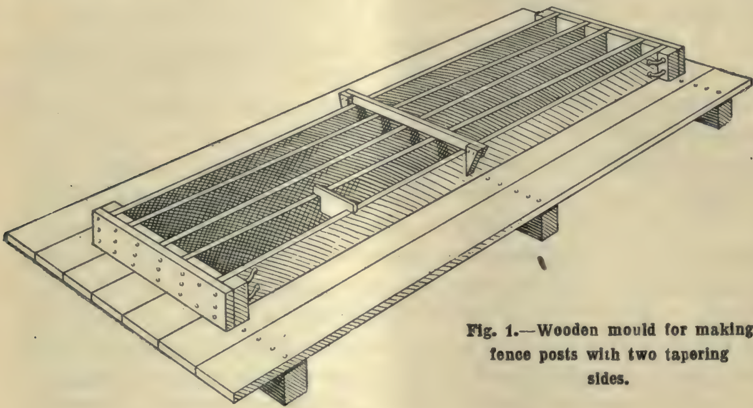
Concrete for Fence Posts.

The concrete should be mixed with Portland cement in about the proportion 1 : 2½ : 5, broken stone or gravel under one half inch being used. In cases where the aggregate contains pieces smaller than one-fourth inch, less sand may be used, and in some cases it may be omitted altogether. A mixture of medium consistency is recommended, on the ground that it fits the moulds better and with less tamping than if mixed quite dry.

Moulds for Fence Posts.

Economy points to the use of a tapering post, which, fortunately, offers no difficulties in the way of moulding. All things considered, wooden moulds will be found most suitable. They can be easily and quickly made in any desired size and form. Posts may be moulded either in a vertical or horizontal position, the latter being the simpler and better method. If moulded vertically, a wet mixture is necessary, requiring a longer time to set, with the consequent delay in removing the moulds. Fig. 1 shows a simple mould which has been used with satisfactory results in this laboratory. This mould has a capacity of four posts, but larger moulds could easily be made on the same principle. It consists of two end-pieces carrying lugs, between which are inserted strips. The several parts are held together with hooks and eyes, as shown in Fig. 1. To prevent any bulging of the side strips, they are braced

as illustrated. Dressed lumber at least 1 inch thick, and, preferably, 1½ inches, should be used. In Fig. 1, the post measures 6 x 6 inches at the bottom, 6 x 3 inches at the top, and 7 feet in length, having two parallel sides. If it is desired to have the posts square at both ends, the moulds must be arranged as in Fig. 2. This latter form of post is not as strong as the former, but requires less



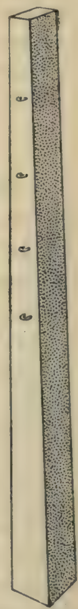
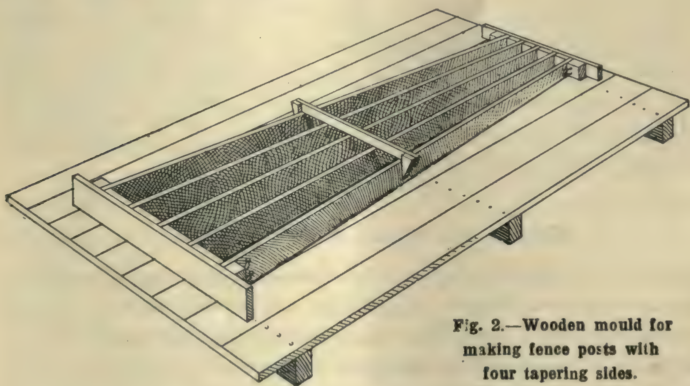


Fig. 1.—Wooden mould for making fence posts with two tapering sides.

concrete in its construction. Great care in tamping is necessary to ensure the corners of the mould being well filled, and if this detail is not carefully watched, the metal, being exposed in places, will be subject to rust.



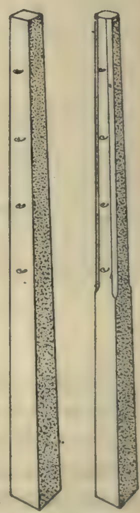


Fig. 2.—Wooden mould for making fence posts with four tapering sides.

Attaching Fence Wires to Posts.

Various devices have been suggested for attaching fence wires to the posts, the object of each being to secure a simple and permanent fastener, or one admitting of easy renewal at any time. Probably nothing will answer this purpose better than a long staple, or bent wire, well embedded in the concrete, being twisted or bent at the end to prevent extraction. Galvanized metal

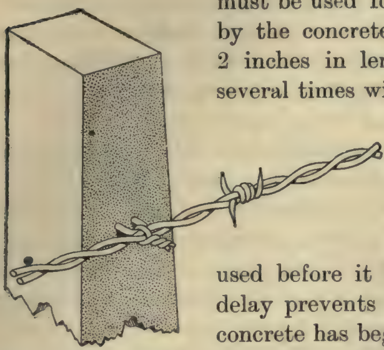


Fig. 3.—Detail showing method of attaching wire to post.

must be used for fasteners, since they are not protected by the concrete. A piece of small flexible wire, about 2 inches in length, threading the staple and twisted several times with a pair of pliers, holds the line wire in position (Fig. 3).

Moulding and Curing Posts.

It is recommended that only so much concrete be mixed at one time as can be used before it begins to harden; but if an unavoidable delay prevents the posts being moulded until after the concrete has begun to set, it is thought that a thorough re-gauging with sufficient water to restore normal consistency will prevent any appreciable loss of strength, though the concrete may have been standing one or two hours. In using a mould similar to those illustrated in Figs. 1 and 2, it is necessary to provide a perfectly smooth and even platform of a size depending upon the number of posts to be moulded. A cement floor, if accessible, may be used to advantage. The moulds, when in place, are given a thin coating of soft soap, the platform or cement floor serving as bottom of mould being treated in the same way. About $1\frac{1}{2}$ inches of concrete is spread evenly over the bottom and carefully tamped, so as to reduce it to a thickness of about 1 inch. A piece of board cut as in Fig. 1 will be found useful in levelling off the concrete to the desired thickness before tamping. On top of this layer two reinforcing members are placed about 1 inch from the side of the mould. The moulds are then filled and tamped in thin layers to the level of the other two reinforcing members, the fasteners for fence wires being inserted during the operation. These reinforcing members are adjusted, as were the first two, and the remaining 1 inch of concrete tamped and levelled off, thus completing the post as far as moulding is concerned. To avoid sharp edges, which are easily chipped, triangular strips may be placed in the bottom of mould, along the sides, and when the moulds have been filled and tamped, similar strips may be inserted on top. The top edges may be bevelled with a trowel, or by running an edging tool having a triangular projection on its bottom, along the edges. Such a tool is shown in Fig. 4, and can easily be made of wood or metal. It is not necessary to carry the bevel below the ground line. The ends and sides of the mould may be removed after twenty-four hours, but the posts should not be handled for at least one week, during which time they must be well sprinkled several times daily and protected from sun and wind. The intermediate strips may be carefully withdrawn at the end of two or three days, but it is better to leave them in place until the posts are moved. Although a post may be hard and apparently

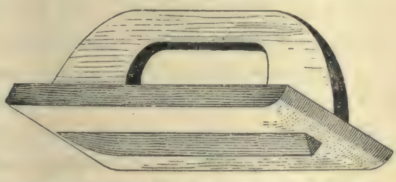


Fig. 4.—Tool used for levelling the edges of posts.

strong when one week old, it will not attain its full strength in that length of time, and must be handled with the utmost care to prevent injury. Carelessness in handling "green" posts frequently results in the formation of fine cracks, which, though unnoticed at the time, give evidence of their presence later in the failure of the posts.

Posts should be allowed to cure for at least sixty days before being placed in the ground, and for this purpose it is recommended that when moved from the moulding platform, they be placed upon a smooth bed of moist sand, and protected from the sun until thoroughly cured. During this period they should receive a thorough drenching at least once a day. The life of the moulds will depend upon the care with which they are handled. A coating of mineral oil or shellac may be used instead of soap to prevent the cement from sticking to the forms. As soon as the moulds are removed they should be cleaned with a wire brush before being used again.

The cost of reinforced concrete fence posts depends in each case upon the cost of labour and materials, and must, necessarily, vary in different localities. One cubic yard of concrete will make twenty posts measuring 6 x 6 inches at bottom, 6 x 3 inches at top, and 7 feet long, and if mixed in the proportion of $1 : 2\frac{1}{2} : 5$, requires, approximately, 1·16 barrels of cement, 0·44 cubic yard of sand, and 0·88 cubic yard of gravel.

Concrete Fencing-posts at the Cowra Experiment Farm.

GEO. L. SUTTON, Manager.

With the prospect of timber for fencing-posts becoming scarcer each year, and because of some prominence being then given to cement concrete, it was decided some twelve months ago to erect a short experimental line of fencing with concrete posts, so as to determine if there were any special difficulties to be met with in this type of post, and to obtain some definite idea under local conditions as to its cost and efficiency.

The length of line erected is $2\frac{1}{2}$ chains, and included in the line are gate-posts, straining-posts, struts, stays, and ordinary posts.

The location of the fence is such as to ensure that the posts are subjected to a fair trial. It is the boundary line between a lane and the paddock in which the stables and other farm buildings are situated. The gateway is the entrance to this paddock, and is in constant daily use. On one occasion a dray collided with one of the gate-posts, but it suffered no appreciable damage. Fig. 5 is an illustration of this kind of fence; its neat appearance commends it.

The posts were made of the following mixture: cement, 1; sand, $2\frac{1}{2}$; gravel, 5. In the case of the ordinary fencing posts and struts, the gravel was small, being about $\frac{1}{2}$ inch. In the larger and bulkier posts the gravel was of a much larger size, some pieces being the size of an egg. The dimensions of the ordinary posts are 6 feet 3 inches long by $3\frac{3}{4}$ x 3 inches at the top, and $5\frac{1}{2}$ x 5 inches at the bottom. Each post is reinforced with four pieces of No. 6 crimped wire, placed 1 inch from each corner. The crimped wire was used because it was on hand, and was considered to be stronger than the plain, but from what has since been learnt it is believed that the ordinary No. 6 plain wire, bent at the ends, would be quite strong enough for reinforcement.

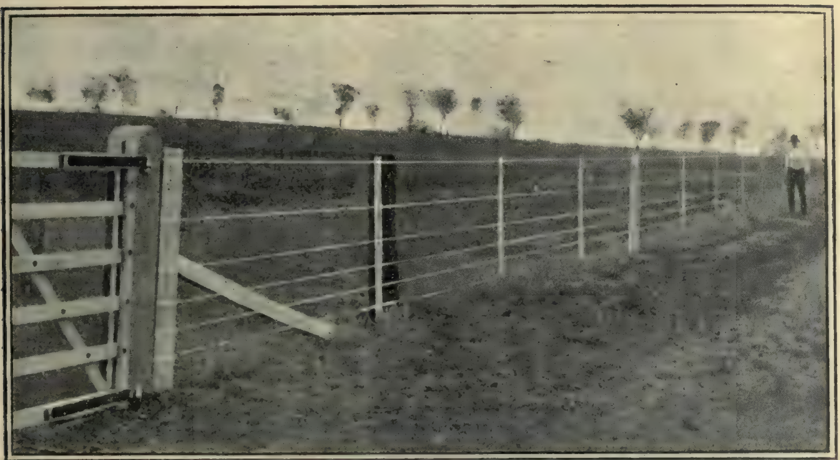


Fig. 5.—Concrete Fencing Posts at Cowra Experiment Farm.

The wires are fixed to the posts, as shown in Fig. 6, by tying wire which passes through holes in the post, and 2 inches from its face. These holes were made when the post was moulded, and are made by putting $\frac{1}{4}$-inch iron rods through the sides and across the mould the required distance apart, *i.e.*, the distance necessary for the spacing of the wires. When the concrete sets, the rods are withdrawn, leaving holes in the post. Two of the rods are in the form of bolts, which on being screwed up hold the mould together, and stiffen it, so that the mould will remain firm when the material is tamped.

Where only plain wires are used on a fence, they can, if desired, be run through the holes in the post, but because of the ease with which a broken wooden or concrete post can be replaced, and because a much neater and better job can be made when affixing netting, it is believed that the proper method of affixing wires is by means of the tie-wires to the face of the post.

The posts were moulded singly in collapsible moulds. The sides of the moulds were of $1\frac{1}{2}$ inch dressed cypress pine, and were kept apart by blocks 2 inches thick at each end. The top block had two small three-cornered fillets tacked to it, in order to give a bevel finish to the top of the post. The

moulds were held together by three bolts, the top and middle bolts being placed so that the holes, which were left when they were withdrawn, were at the required distance apart to correspond with the spacing required by two of the wires in the fence.

When making the post the mould, after being cleaned and greased, was placed on a board, so that the back of the post would be underneath, and sufficient material in a soft state to cover the bottom about 1 inch deep was placed therein. Two of the reinforcing wires were then placed on the concrete, at about 1 inch from each side, and extending from within 2 inches of one end to the same distance from the other end. The mould was then half filled, and the rods to make the holes for the fencing wires passed through the sides. Material was then placed in the mould to within 1 inch of the top, when the remaining two reinforcing wires were put in a similar position to the first two, and the mould filled. After being filled the material was worked to the sides by passing a trowel or spade between the material and side of frame or mould. When this had been done the material was thoroughly tamped with a small rammer. This operation brought the fine material to the top, which, on being smoothed off with a trowel or float, gave a smooth surface to the face of the post.

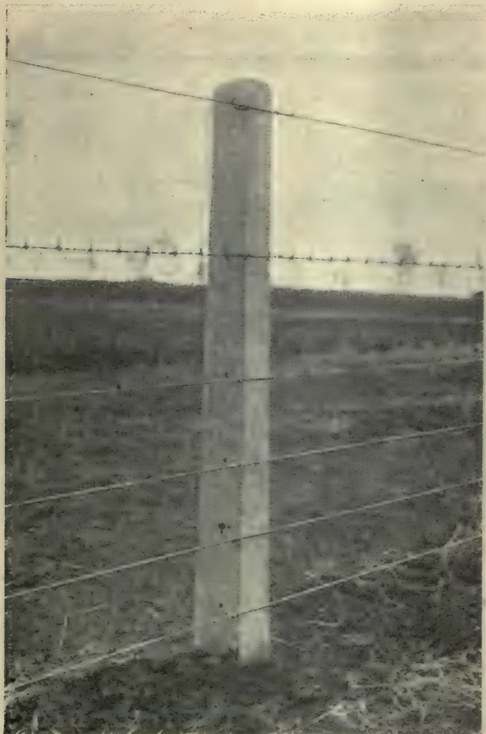


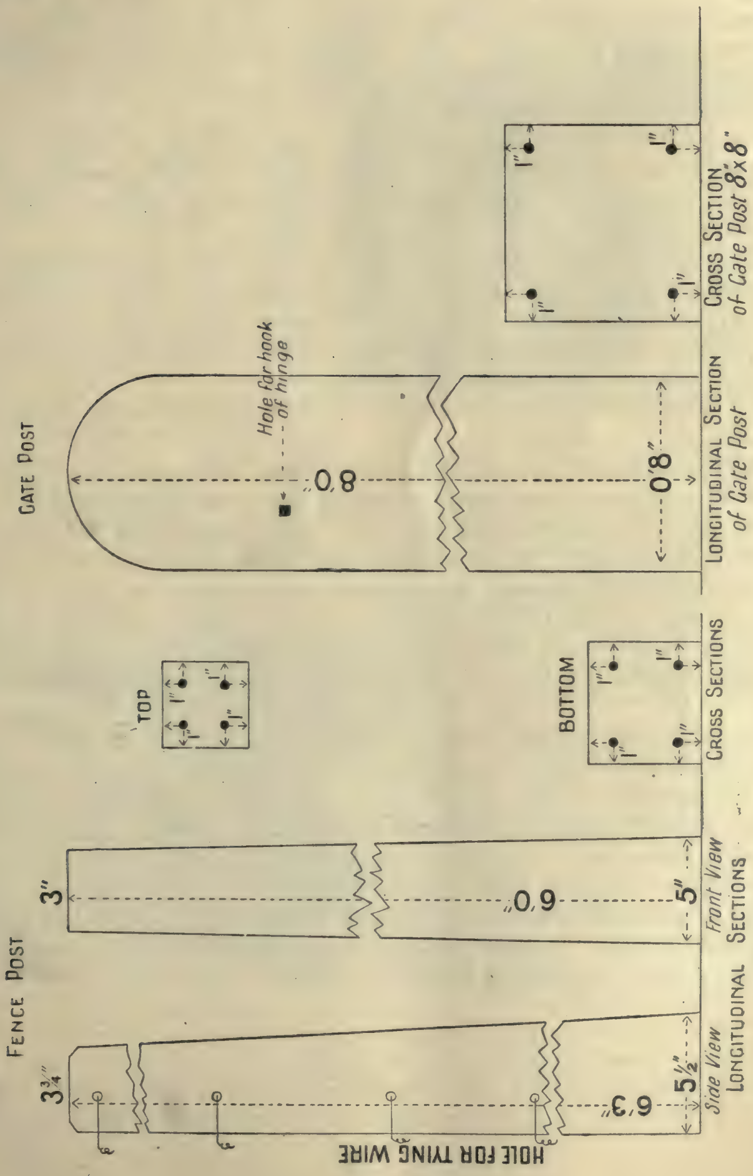
Fig. 6.—Concrete Fencing Posts at Cowra Experiment Farm.

After the concrete had been allowed to set for two or three hours, the bolts were unscrewed and the mould taken apart, cleaned, and greased for another post. The newly-made post was kept in the shade to season for about a fortnight, being watered daily for the first week so as to retard the progress of setting.

No difficulty was experienced in making these posts, nor had those engaged in making them had previous experience with concrete. The information necessary to make them was acquired through reading "Concrete Dwellings and Farm Buildings" (F. G. Chomley), in the *Agricultural Gazette*, April, 1907. From this it is quite evident that, with intelligent direction, the

work can be quite easily carried out on a farm with the ordinary labour available.

Information which has been gained since the posts were made, has given the impression that the material could be used much drier, and though this would require more tamping, it would admit of the moulds being removed sooner from the posts without injury to them. It is also believed that the posts could be moulded on the ground, or on a bed of sand, instead of on boards.



The actual details of making the posts will vary according to the facilities available on different farms. If desired the moulds can be made in sets, and several posts made at a time. Under certain circumstances this plan will perhaps be found the most suitable, but for continuous work it is believed that making a single post in a collapsible mould will be found the better plan. If a single collapsible mould be used, it can be removed much sooner, and with less risk of injury to the post, than if a compound mould be used.

The gate, straining-posts, and struts were made in a similar way to the ordinary posts, in moulds of the proper size. In each case stronger reinforcing rods of $\frac{3}{8}$-inch round iron were used. It is believed that the $\frac{3}{8}$-inch reinforcing rods in the struts or stays could be replaced with $\frac{1}{4}$-inch rods without unduly weakening them.

The holes for the hooks of the hinges were made in the gate-posts by placing the hooks or gudgeons to be used in their relative position in the moulds. The tops of the gate-posts were rounded by placing a block of wood the required shape at the head of the mould.

The straining-posts are 7 feet 9 inches long, with a cross section of 8 inches x 6 inches. At 1 foot 10 inches from the top, a slight rectangular recess is moulded obliquely in the centre of one of the narrower sides for the reception of the end of the stay or strut. The straining-posts are placed 3 feet 6 inches in the ground.

The stays or struts are 9 feet long, with a cross section of 4 inches x 3 inches.

The appearance of the posts is improved if, after completion, they are given a coat of thin cement wash, made by mixing cement thinly with water.

The cost of fencing-posts made of concrete will depend upon the local cost of the material used. It is estimated that where suitable gravel and sand is easily obtainable concrete fencing-posts can be made for about 1s. each (labour and material). Fencing-posts of the dimensions given require about 18 lb. of cement, which at this farm costs about 8d. With sufficient moulds available, it is believed that a man could make about 100 posts per day.

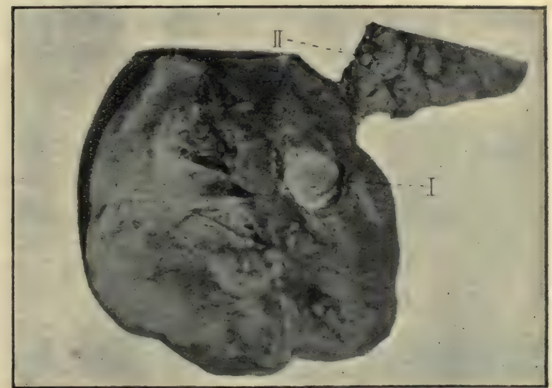
The experience gained with the short line of fence erected at Cowra Experiment Farm shows beyond doubt that concrete is a suitable material for fencing-posts in this climate. Concrete posts do not require specially skilled labour to make, they are neat, efficient, and durable, being unaffected by white ants or rot, and probably also by bush fires, Their first cost, however (about 1s.) makes their use uneconomical in districts where wooden posts are still easily obtainable. Concrete gate-posts are a decided advantage over wooden ones. Unsightly cracks do not appear in them, nor do they require painting regularly to keep them neat and in good order.

An Uncommon Kidney Parasite of Pigs.

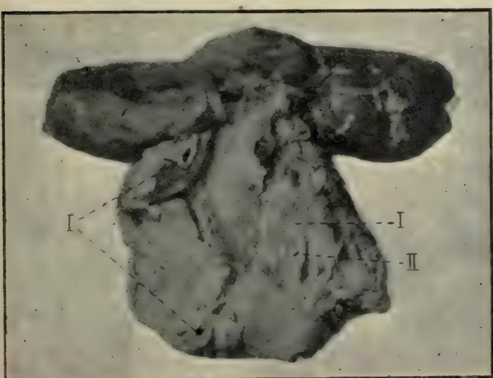
Sclerostoma Pinguicola.

MAX HENRY, M.R.C.V.S., Government Veterinary Surgeon.

A few days after farrowing, a sow was noticed to be weak in the hind-quarters, and later became partially paralysed. This was attributed to injury received from a sudden wrench or twist, as she had been seen running vigorously a few hours before. There was no sign of general disturbance, the functions were all performed properly, and there was no discharge from the vulva. A week later she was in the same condition, but from then the paralysis became more marked in spite of treatment, and it was decided to slaughter her, as muscular atrophy had set in, paralysis extended to bladder and rectum, and secretion of milk ceased. On making a *post mortem* examination, the abdomen when opened appeared to be almost entirely occupied by a greatly distended bladder showing an intense inflammation (*cystitis*) with gangrenous patches, and containing a large quantity of turbid urine and many small whitish clots. The ureters were much thickened and hard, and both kidneys were about four times the normal size. On section some pus-like material occupied the pelvis of the kidney, and in the left kidney was a fair-sized abscess cavity containing a small worm. On laying open the ureters further worms were found, some wholly in the tube, others projecting into it from round apertures leading into diverticula in the



Left Kidney.
I. Abscess cavity which contained worm II. Thickened ureter

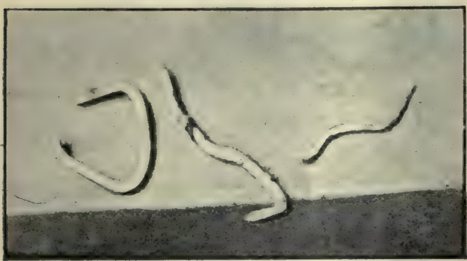


Right Kidney.
I. Ureter laid open. II. Entrances from ureter to worm nests.

surrounding fatty tissue. These diverticula contained two or three worms each and some pus-like fluid. The worms were found to answer to the description given by the Bureau of Animal Industry (U.S.A.) of the Sclerostoma Pinguicola (*Stephanurus Dentatus*, Neu.).

The worms are mottled, body attenuated in front, and the mouth terminal, the male growing to about an inch in length and the female slightly larger. They appear to be fairly common in the United States of America, and are supposed to cause paralysis of the hind-quarters. How they gain their position in the kidney is not definitely known, but it would appear probable that the eggs are passed out with the urine, and so gain the pastures, and even the drinking water of pigs, by whom they are swallowed.

Further cases have been reported in the same district in which this case occurred, but it is not known to what extent the pigs of this State are infested, and further specimens, with information as to the age of the affected pigs, conditions under which they are kept, and state of health at time of slaughter or death, are hereby asked for.



Sclerostoma Pinguicola (natural size).

Treatment cannot be called hopeful owing to the impossibility of knowing when a pig may be infested, except in the last stages when the pathological changes would be so extensive as to render recovery almost hopeless; but should infested pigs be found in a sty, efforts may be made to prevent infestation of those remaining. These consist, as in most diseases of pigs, in general hygienic measures such as cleanliness of sties, feeding out of troughs, and watering from troughs, while in addition an occasional dose of linseed oil 4 to 8 ounces, according to age, and turpentine 1 to 4 drachms, according to age, might be administered to expel eggs or embryos from the alimentary tract, or a dose of 2 or 3 ounces of magnesium sulphate might be given, followed as soon as purgation is induced, by extract of male fern, 1 drachm, turpentine 1 drachm, and oil or milk 2 ounces. As a tonic to improve the general tone of the pigs suspected of being infested, and so enable them to offer a better resistance to the parasite, a mixture of sulphate of iron 1 part, sulphur 2 parts, powdered gentian root 6 parts, and bone meal 10 parts, might be prepared and given to the pigs in the feed daily at the rate of a dessert-spoonful per pig. As will be very evident, however, complete prevention can hardly be looked for.

Government Stud Bulls available for service at State Farms, or for lease.

Breed.	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till
Shorthorn ...	Dora's Boy ...	Cornish Boy ...	Lady Dora ..	Berry Farm ...	*
,, ...	Royalty ...	Royal Duke II..	Plush ...	Tuckurimba (near Coraki).	7 June, '09.
,, ...	Pansy Duke ...	Earl March ...	Pansy 4th ...	Wollongbar Farm.	*
,, ...	March Pansy ...	Earl March ...	Australian Pansy	Grafton Farm ...	*
,, ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd.	Berry Farm ...	*
Jersey ...	Thessalian II ...	Thessalian ...	Egyptian Princess	Steve King's Plains (near Coraki).	8 June, '09.
,, ...	Golden Lord ...	Golden King ...	Colleen ..	Wagga Exp. Farm	*
,, ...	Sir Jack ...	Omelette's Pride	Lady Tidy 3rd (imp.).	Berry Farm ...	*
,, ...	Berry Melbourne	Melbourne ...	Rum Omelette	Berry Farm ...	*
Guernsey ...	Gentle Prince ...	Rose Prince ...	Gentle ...	Coraki	Sept., '09.
,, ...	The Admiral ...	Hawkes Bay ...	Vivid... ..	Wollongbar Farm.	*
,, ...	Prince Milford..	Rose Prince ...	Flaxy ...	H.A.College, Richmond	*
,, ...	Vivid's Prince...	Rose Prince ..	Vivid ...	Upper Orara ...	May, '10.
,, ...	Prince Edward..	Rose Prince ...	Vivid ...	Woodburn	21 Oct., '09.
,, ...	Star Prince ...	Calm Prince ...	Vivid ...	Alstonville District	17 June, '09.
,, ...	Prince Souvia...	Vivid's Prince...	Souvenir ...	Wollongbar Farm.	*
Red Poll ...	The Judge ...	Barrister ..	Lovely 8th ...	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General... ...	Judy 9th ...	Bathurst Farm ...	*
,, ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	†
,, ...	Auchenbrain Spicy Jock (imp).	Howie's Spicy Robin.	Another Mayflower	Berry Farm ...	*
,, ...	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
,, ..	Jamie's Ayr ..	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
,, ...	Emerald's Mischief.	Prince Emerald	Miss Prim ...	H.A.College, Richmond	*
,, ...	Dado	Daniel	Dot	H.A.College, Richmond	*
Kerry	Bratha's Boy ...	Aicme Chin ...	Bratha 4th .	Glen Innes Farm...	†
,, ...	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Dexter Kerry	Waterville Punch.	....	.. ..	Grafton Farm ...	*
Holstein ...	The Hague ...	President ...	Lolkje Veeman	H. A. College, Richmond	*
,, ..	Obbe II ...	Obbe	La Shrapnel..	Wollongbar Farm	*
,, ...	Hollander ...	Bosch III ..	Margaretha ...	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

List of Fertilisers in New South Wales

F. B. GUTHRIE AND L. COHEN.

1909 List.

THE accompanying list of manures obtainable in New South Wales, together with their composition, as guaranteed by the vendors, and their values, is the result of the revision of the list issued in April, 1908.

The list is published in the interest of the farmers, and it is hoped that it may serve as a guide to those requiring any particular class of manure.

It must be clearly understood that the figures given are not those obtained by analysis of the sample by the Department. They represent the guarantees given by the vendors in accordance with the provisions of the Act.

Where possible, samples have been taken from bulk by one of the officers of the Department, and only those manures are inserted in the list which have been found on analysis to be up to the guarantee.

A word is necessary in explanation of the column giving the "values" of the manures. These figures are calculated from the composition of the manures as represented by analysis, a definite unit-value being assigned to each of the fertilising ingredients. The units on which the values here given are computed are as follow :—

UNIT-VALUES of fertilising ingredients in different manures for 1909.

	Per unit. s.	d.
Nitrogen in nitrates ...	15	1
,, in ammonium salts ...	13	9
,, in blood, bones, offal, &c.—fine ...	15	0
Phosphoric acid in bones, offal, &c.—fine ...	3	0
Potash in sulphate of potash ...	5	2
Potash in muriate of potash ...	4	8
Phosphoric acid in superphosphate and mineral phosphate—		
Water-soluble ...	5	2
Insoluble ...	2	9

PRICE per lb. of fertilising ingredients in different manures for 1909.

	Pence per lb.
Nitrogen in nitrates ...	8·1
,, in ammonium salts ...	7·4
,, in blood, bones, offal, &c.—fine ...	8·0
Phosphoric acid in bones, offal, &c.—fine ...	1·6
Potash in sulphate of potash ...	2·8
Potash in muriate of potash ...	2·5
Phosphoric acid in superphosphate and mineral phosphate—	
Water-soluble ...	2·8
Insoluble ...	1·5

To determine the value of any manure the percentage of each ingredient is multiplied by the unit-value assigned above to that ingredient, the result

being the value per ton of that substance in the manure. For example, a bone-dust contains 4 per cent. nitrogen and 20 per cent. phosphoric acid:—

4 x 15s. 0d. = £3 0s. 0d. = value of the nitrogen per ton.
20 x 3s. 0d. = £3 0s. 0d. = value of the phosphoric acid per ton

£6 0s. 0d. = value of manure per ton.

It must be clearly understood that the value thus assigned, depending solely upon the chemical composition of the manure, does not represent in all cases the actual money value of the manure, which depends upon a variety of causes other than the composition, and is affected by local conditions. Neither does it represent the costs incurred by the manufacturer in the preparation, such as cost of mixing, bagging, labelling, &c. It is simply intended as a standard by which different products may be compared. At the same time, it has been attempted to make the standard indicate as nearly as possible the fair retail price of the manure, and the fact that in the majority of cases the price asked and the value assigned are fairly close shows that the valuation is a reasonable one.

These figures have been checked in all cases by analyses made on samples collected by an officer of the Department. It by no means follows, however, that the particular product analysed and here published will be in stock for any length of time.

Some agents guarantee two figures—for instance, "from 16 to 18 per cent. phosphoric acid." In these cases the lower one has been published in the list, as it will certainly be the one the vendors will rely upon in cases of dispute.

Now that the Fertiliser Adulteration Act is in force, the purchaser has only himself to blame if he pays for an inferior article. Every vendor is obliged to furnish a guarantee with every delivery of fertiliser, setting forth its actual composition as determined by analysis.

If the purchaser has any reason to suspect the genuineness of the guarantee, all he has to do is to notify the vendor of his intention to take samples for analysis, in sufficient time to enable the vendor or some person appointed by him to be present. The samples must be taken before the consignment is finally in the purchaser's possession; for example, if the fertiliser is sent by rail, the sample should be taken at the railway station or siding. Three samples must be taken, one being given to the vendor or his representative, the second kept by the purchaser and submitted to an analyst, and the third forwarded to the Department of Agriculture for future reference, in case of divergence in the analyses of the other two. All three samples must be sealed up.

In the case of bone-dust, blood, and bone manures, &c., the valuation has been made irrespective of the fineness of division, and is based on the amounts of fertilising ingredients only; but it must be borne in mind that finely ground bone-dust acts more rapidly than coarse, and that unground fragments of bone only become available as fertilisers very slowly.

A word may be added in explanation of the term water-soluble phosphoric acid. When bones or mineral phosphates are acted on by sulphuric acid, a

portion of the tricalcic phosphate is converted into another lime compound, known as monocalcic phosphate or superphosphate. This compound is soluble in water, and it is to its presence that the rapid action of the phosphate is due. This is the "water-soluble" acid of the table. In many superphosphates, however, a considerable portion of this compound has undergone change. This change may be due to the salts of iron and alumina present, or to the length of time it has been kept, and it results in the formation of a third lime compound—bi-calcic phosphate. This is known as "reverted" or "retrograde" phosphoric acid, and is insoluble in water, but soluble in ammonium citrate.

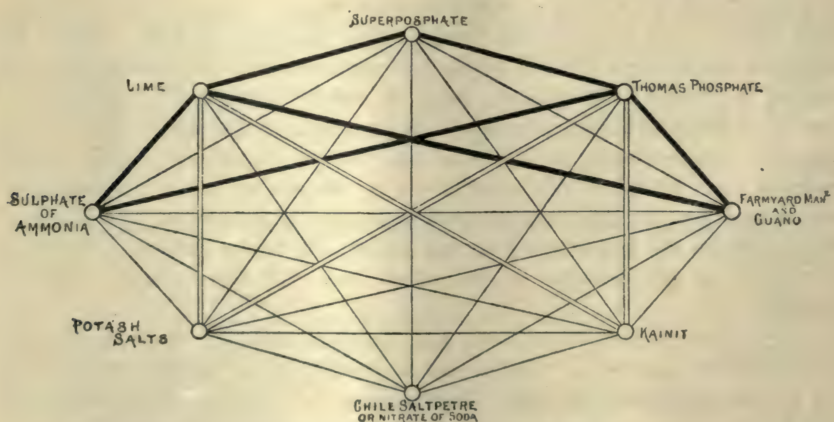
In the fourth table are a number of waste products which may in many cases be economically utilised.

When purchasing a manure always insist on a guarantee of its composition as determined by analysis.

Artificial manures should be mixed with about three times their weight of dry loam, and distributed evenly.

Never add lime to a manure containing sulphate of ammonia or blood and bone manures, as in these cases loss of nitrogen results; and when lime has been applied to the land do not use such manures until about three weeks afterwards.

The accompanying fertiliser diagram, which represents in a graphic manner the points to be taken into consideration in the mixing of different manures, is reproduced in the hope that it will be found useful to farmers who make up their own mixtures. The diagram originates with Dr. Geekens, Alzey, Germany, and is taken from an article by Mr. Leo. Buring in the *Garden and Field* of 10th October, 1903.



Substances connected by thick line must not be mixed together.
Substances connected by double line must only be mixed immediately before use.
Substances connected by single thin line may be mixed together at any time.

I.—Simple Fertilisers.

Manure.	Where obtainable.	Guaranteed Composition.					Manurial Value.
		Nitrogen.	Equivalent to Ammonia.	Lime (CaO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).	£ s. d.
Sulphate of Ammonia...	Australian Gaslight Co., Kent-street, and any manure merchant.	20·40	24·77	......	......	......	14 0 6
Nitrate of Soda...	Gibbs, Bright, & Co., 37, Pitt-street, and any manure merchant.	15·90	19·30	... ..	......	......	12 0 0
Kainit	Potash Syndicate, and any manure merchant...	.....	.....	......	12·5	......	3 4 7
Muriate of Potash	" " ...	......	......	......	60·0	......	14 0 0
Sulphate of Potash	" " ...	......	......	......	52·0	......	13 10 0
30 % Potash Manure	" " ...	......	......	......	30·0	......	7 0 0
Thomas' Phosphate	A. H. Hasell, 2, Bridge-street	......	......	......	......	18·0	......
" "	"K.P.N." Fertiliser Co., 12, Spring-street ..	......	......	......	......	16·2	......
Building Lime*...	Sydney and North Sydney Lime and Cement Co., 17, Pitt-street.	......	.. ...	95·0 (about).	......	......	......
Gypsum Fertiliser*	A. H. Hasell, 2, Bridge-street	......	......	98·0 cryst. $CaSO_4$	......	......	......

* Lime and Gypsum not guaranteed.

II.—Bone and Blood Manures.

Manure.	Where obtainable.	Guaranteed Composition.				Manurial Value.
		Nitrogen.	Equivalent to Ammonia.	Phosphoric Acid.	Equivalent to Tricalcic Phosphate.	
						£ s. d.
Special fertiliser, No. 3	Co-operative Wholesale Society, Alexandria ...	5·0	6·07	18·3	40·0	6 9 11
Bone and blood B.B.	Waratah Fertiliser Co., Ida-street, Waratah ...	6·0	7·29	15·0	32·75	6 15 0
Bone-dust	,, ,, ,, ,, ...	4·12	5·0	22·9	50·0	6 10 6
Dried blood	Colonial Fertilisers Co., 117, Pitt-street	10·7	13·0	...	...	8 0 6
Fish manure	,, ,, ,, ...	6·18	7·5	11·45	25·0	6 6 0
Bone-dust, B.D. 2	Paton, Burns, & Co., corner of Sussex and King Streets.	3·7	4·49	22·12	48·29	6 1 0
,, B.D. 3	,, ,, ,, ,, ...	3·3	4·0	20·7	45·19	5 11 7
,, B.D. 4	,, ,, ,, ,, ...	3·3	4·0	18·4	40·17	5 4 8
Bone and blood, B.B.	,, ,, ,, ,, ..	5·35	6·5	11·91	26·0	5 16 0
Blood	,, ,, ,, ,, ...	10·7	13·0	...	...	8 0 6
Bone and blood manure	R. S. Lamb & Co., 55, Pitt-street	5·76	7·0	13·74	30·0	6 7 7
A 1 bone-dust	,, ,, ,, ...	4·12	5·0	18·78	41·0	5 18 2
*** bone-dust	,, ,, ,, ...	3·91	4·75	23·82	52·0	6 10 1
Raw bone-dust	,, ,, ,, ...	3·91	4·75	23·82	52·0	6 10 1
Vulture manure	,, ,, ,, ...	4·0	4·85	18·32	40·0	5 14 11
Blood	,, ,, ,, ...	11·53	14·0	...	...	8 12 11
Raw or green bone-dust	A. Wooster, Epping	4·01	4·86	24·41	53·3	6 13 5
Blood and bone-dust	,, ,, ...	5·76	7·0	13·74	30·0	6 7 2
Pure steamed bone-dust	,, ,, ...	3·91	4·75	24·50	53·5	6 12 2
Phosphatic bone-dust	,, ,, ...	3·30	4·0	21·18	46·25	5 13 0
Blood	,, ,, ...	13·17	16·0	...	...	9 17 6
Blood and bone manure	A. H. Hasell, 2, Bridge-street	5·5	6·68	18·0	39·29	6 16 6
Blood	,, ,, ,, ...	12·36	15·0	...	...	9 5 5
Bone-dust	,, ,, ,, ...	3·75	4·55	22·5	49·1	6 3 9

III.—Superphosphates, Mixed Fertilisers, and Imported Fertilisers.

Manure.	Where obtainable.	Guaranteed Composition. Nitrogen.	Water soluble Phosphoric Acid.	Total Phosphoric Acid.	Potash.	Manurial Value £ s. d.
Ohlendorff's Dissolved Peruvian Guano.	Gibbs, Bright, & Co., 37, Pitt-street ...	5·0	9·0	10·0	1·5	6 12 0
Superphosphate, 36–38 per cent.	George Shirley, Limited, 279, George-street...	...	17·0	...	...	4 7 10
Superphosphate, 40 per cent.	,, ,,	...	18·3	...	...	4 14 6
A 1 Superphosphate ...	A. H. Hasell, 2, Bridge-street ...	...	19·0	19·75	.	5 0 3
No. 1 Superphosphate ...	,, ,,	...	17·5	18·5	...	4 13 2
Marion Guano	,, ,,	...	...	27·48	...	3 15 7
Nitro-superphosphate ...	,, ,,	1·35	15·44	19·05	...	5 8 2
Bone and superphosphate..	,, ,,	1·5	9·0	20·5	...	5 0 7
Guano	Paton, Burns, & Co., corner of King and Sussex streets...	...	...	27·48	...	3 15 7

IV.—Waste-Products, Ashes, &c., not on the Market.

Manure.	Original Source.	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble.	Lime.	Phosphoric Acid.	Potash.	Manurial Value. £ s. d.
Deposit from wool-scouring tanks. (1)	Liverpool Wool-scouring Works.	...	...	·64	·78	...	...	...	·72	0 12 6
,, (2)	,, ,, ,,	...	...	1·02	1·24	...	...	·16	·39	0 16 5
,, (3)	,, ,, ,,	...	...	1·37	1·66	...	...	·14	·20	1 0 2
Deposit from breakers	,, ,, ,,	34·47	(spanning)	1·81	2·20	50·68	·85	·88	1·60	1 15 0
Sediment from wool-scouring works.	Yass	19·57	(spanning)	·59	·71	78·24	·97	...	·20	0 9 10
Scutch	Australian Glue-Gelatin Works, Alexandria.	56·98	...	2·95	3·58	...	4·56	None.	None.	2 4 3
,, from limed pelts	Hugh Wright, Auburn	5·32	73·42	1·80	2·18	3·61	9·36	·89	·20	1 8 2
Decomposed hair and lime	Fellmongery	9·70	57·08	6·86	8·33	1·22	26·27	...	...	4 13 9
Tan-yard refuse	Tanneries, St. Mary's	6·43	33·83	2·24	2·72	21·43	26·96	·67	...	1 19 5
Tan refuse	...	7·10	50·90	2·62	3·18	16·03	18·58	·56	·18	2 1 11
Fleshings from tannery	...	4·91	75·37	4·43	5·38	5·98	...	1·14	·04	3 9 10
Salt (sweepings from tannery)	...	3·04	...	·70	·85	·38	...	...	...	0 10 6
Wool-waste	...	...	...	8·15	9·89	...	...	...	...	6 2 3
,,	...	34·33	28·20	1·97	2·39	26·03	2·75	·37	·32	1 10 8
Peat	H. Tager, Moss Vale	72·93	16·68	·35	·42	10·39 (ash).	...	...	...	0 5 3
,,	S. Cook, Pyrmont	49·51	34·63	·75	·91	...	...	·06	·01	0 11 3
Burnt peat	...	...	...	...	...	84·45	...	·25	·33	0 2 6
Filter-press muck	Cane-mills, Broadwater	16·39	26·07	·22	·27	34·86	13·20	5·98	·44	1 3 6
Megass	Clarence River cane	22·86	67·32	·63	·78	8·61	·30	·01	·05	0 9 5
Megass ash	,, ,,	...	...	...	...	87·69	3·07	·16	·51	0 3 0
,,	Richmond River cane	...	...	...	...	...	1·11	·28	4·79	1 5 6
Bloodwood ash	...	...	...	...	...	...	8·47	·27	5·25	1 7 10
Ironbark ash	...	...	...	...	...	...	...	·82	1·53	0 10 3
Blackbutt ash	...	...	...	...	...	...	7·27	·04	2·02	0 10 7
Red-gum ash	...	...	...	...	...	...	...	·38	4·17	1 2 7
Spotted-gum ash	...	...	...	...	...	...	...	·10	·70	0 3 11
Boxwood ash	...	...	...	...	...	...	...	·67	1·65	0 10 5
Grass-tree ash	...	·86	1·78	...	...	33·48	24·94	3·07	5·30	1 16 1
Vine-cuttings ash	...	·49	...	...	...	60·64	11·34	1·85	3·76	1 4 8
Red-apple ash	...	...	...	...	...	54·52	14·96	·47	6·00	1 12 4
She-oak ash	...	...	...	...	...	8·57	42·35	8·85	2·19	1 16 5
Hardwood ash	...	·50	1·35	...	...	62·38	13·50	1·76	3·09	1 1 3
Ash of wild melon	Stock Branch	...	...	...	...	...	5·12	4·85	27·08	7 14 5
Wood ashes	...	·30	...	...	...	21·43	41·37	·35	2·80	0 15 6
,,	Wentworth Irrigation Area	...	...	...	...	11·12	50·78	·58	3·31	0 18 8
Ash of kerosene shale	Hartley Vale	1·49	27·93	·70	·85	67·59	...	·28	·14	0 11 1

IV.—Waste-Products, Ashes, &c., not on the Market—*continued*.

Manure.	Original Source.	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble.	Lime.	Phosphoric Acid.	Potash.	Manurial Value.
										£ s. d.
Clinker from locomotive boiler									·25	0 1 4
Residue from furnace	R. E. Bragg, Marrickville	1·55	35·63	·54	·61	52·40	·64	·43	·09	0 9 4
Sea-weed ash							9·27	·49	·59	0 4 7
,,							6·29	1·27	17·55	4 14 6
,,		·43				56·28	9·39	·47	2·26	0 13 1
,,	Manly					43·06	6·52	·91	13·98	3 15 0
,,	,,					·07	·53	·19	34·30	8 17 9
,,	Mr. Harvey, Department	3·25	19·46			61·63	4·22	·33	·22	0 2 1
Sea-weed, fresh state		80·00		·16	·19		·41	·09	1·18	0 8 6
Sea-weed		41·03	42·49	·14	·17			·21	·60	0 5 10
Sea-weed, dried		18·58	65·97	1·64	1·99	15·44 (ash).	3·44	·14	·14	1 5 9
Air-slacked lime		16·58				1·88	75·44			
Residue from calcium carbide		41·36				1·08	36·19			
Limestone rock	Queanbeyan	1·10				4·70	48·20	1·22		0 3 4
Agricultural lime	Portland Cement Co.	18·43				23·80	Hydrate 13·80 Carbonate 43·97			
Gypsum	Marulan	(Crystallised $CaSO_4$ = 92·64)				4·47				
Cave deposit, shells &c.	Cowan, Hawkesbury River	2·11		·82	1·00		35·40	1·59	·88	1 1 7
,, ,,	Macleay River	23·06	16·01	2·43	2·95	26·77	13·88	7·40		2 18 8
Deposit (coral, shell, &c.)	Pacific Islands	2·13	13·53	·72	·87		44·00	3·53	·39	1 3 6
Shells	Pambula River						44·59	·10		
Flue deposit	Maitland					83·75	2·56	·32	·31	0 2 6
,,	Liverpool					91·17	·42	1·29	·17	0 4 8
,, from sanitary furnace						63·53	6·64	1·82	1·61	0 13 9
,,		6·30	2·45			84·89	·32	·35	·38	0 2 0
Night-soil mixed with lime		44·33		·74	·89	18·60	27·62	·78		0 13 5
Night-soil	Wagga Wagga	6·70		·03	·04	82·19	·44	·28	·69	0 4 9
,,	,,	9·14		·28	·34	78·92	1·18	·18	·54	0 7 6
,,	,,			·50	·61			·64	·62	0 12 7
Night-soil preparation, No. 1		8·22		3·73	4·63	50·22	13·32	9·65	·91	5 0 1
,, ,, No. 2		7·20		1·83	2·22	29·02	6·05	4·10	·15	2 7 1
,, ,, No. 3		25·95		1·64	1·99	60·17	1·39	1·61	·70	1 12 11
,, preparation, "Pinhoe" manure.		·92	9·54	·21	·25	57·58	14·71	1·26	·56	0 9 7
Night-soil preparation	F. Artlett, Parramatta	7·33	30·06	2·10	2·55	46·38	2·09	1·92	·61	2 0 5
,, ,,	,, ,,	10·11	42·59	4·97	6·02	·94	30·12	·39		3 15 9
,, ,,	Mr. Halstead, O'Brien's patent.	1·54	12·36	·54	·65	77·95		·63		0 10 0
,, ,,		29·52	56·15	2·55	3·10	14·33 (ash).				1 18 3

IV.—WASTE-PRODUCTS, ASHES, &C., NOT ON THE MARKET—*continued.*

Manure.	Original Source.	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble.	Lime.	Phosphoric Acid.	Potash.	Manurial Value.
										£ s. d.
Farmyard-manure	....	67·96	22·09	·40	·49	8·16	·16	·20	·30	0 8 1
Stable manure	Bathurst	39·26	....	·41	·50	....	......	·27	·67	0 10 5
Fowl manure	....	3·95	16·48	1·47	1·78	70·16	2·10	1·94	....	1 7 10
"	....	1·54	15·23	·86	1·04	79·96	·64	·59	·33	0 16 5
Sheep manure	Bathurst	7·73	....	1·06	1·30	....	....	·69	1·17	1 4 0
"	Liverpool Wool-scouring Works.	9·71	50·91	1·79	2·17	32·26	2·00	·91	·92	1 14 4
Sheep dag	....	....	....	3·04	3·69	....	....	....	....	2 5 7
Refuse manure	Abbatoirs	12·00	74·51	4·14	5·03	6·56	....	1·80	....	3 7 6
Flying-fox manure	....	1·09	35·34	3·34	4·05	50·29	1·02	·36	1·15	2 17 1
Fish fertiliser	....	14·47	64·36	10·37	12·59	4·52	....	....	....	7 15 6
Shark fertiliser	....	9·02	68·04	10·59	12·85	3·86	....	7·27	....	9 0 8
Fish manure	....	10·88	59·26	6·10	7·40	5·39	9·82	8·28	....	2 17 1
Rabbit hair, long	Anderson, Oxford-street..	8·73	88·64	14·03	17·04	3·63 (ash).	....	....	....	10 10 5
" short	....	9·72	87·76	14·00	17·00	2·82 (ash).	....	....	....	10 10 0
Bat-guano	....	14·11	17·69	1·55	1·88	28·77	13·72	11·42	....	2 17 6
"	....	10·86	19·65	2·24	2·72	51·95	1·75	3·55	·15	2 13 7
"	....	13·70	34·35	4·76	5·78	3·30	22·28	13·04	trace.	5 0 6
Bat deposit	Cave Flat, Cooradigbee ..	5·43	12·98	·50	·61	57·64	5·60	12·12	....	2 3 10
Guano deposit	Tamworth	8·75	38·40	6·17	7·49	12·85	....	9·24	....	6 0 3
" "	"	8·42	20·97	3·10	3·76	31·89	....	7·87	....	3 10 1
" "	"	14·55	29·91	3·66	4·44	15·81	....	12·98	....	4 13 10
" "	"	9·35	44·32	6·73	8·17	7·33	....	13·17	....	7 0 5
Bone breccia	Queanbeyan	5·71	....	·59	·72	9·48	42·80	3·11	....	0 18 2
Muck from waterworks reservoir	Maitland	4·84	17·55	·74	·90	63·42	4·56	·31	·60	0 15 1
Muck raked from waterhole ..	....	63·66	29·86	·81	·98	3·80	·96	·10	·06	0 12 9
Sawdust	....	32·52	62·35	·82	1·00	....	....	1·70	·05	0 17 6
Decayed wood, bark and leaves, bloodwood.	....	57·80		·74	·89	40·68	1·30	....	....	0 11 1
Decayed wood, bark and leaves, pepper-tree.	....	79·92		·89	1·08	17·77	1·50	....	....	0 13 4
Coco-nut oil cake	....	8·24	....	3·29	3·99	....	....	1·20	1·49	3 0 7
Castor cake	....	18·81	74·08	4·30	5·22	....	....	1·83	·86	3 14 5
Pea cake	Java	16·02	....	7·24	8·79	....	....	1·46	1·17	5 19 0
Bean cake	North China	14·52	80·32	6·77	8·22	....	....	1·33	1·99	5 15 9
Rice husks	....	42·74	42·15	1·07	1·30	13·77	·02	·03	·04	0 16 4
Field pea, whole plant	....	88·58	9·97	·55	·67	....	·15	·12	·49	0 11 2
Tares, whole plant	....	83·97	14·96	·73	·88	....	....	·11	·21	0 12 5
Marsh mallow, whole plant ..	....	79·00	17·86	·85	1·03	....	....	·14	·69	0 16 9
Horse bean, leaves and stalks ..	....	82·87	15·90	·90	1·09	....	·05	·11	·54	0 16 7

Rabbit Destruction.

G. M. McKEOWN, Manager, Wagga Experiment Farm.

Fumigation with Carbon Bisulphide.

On the Wagga Experiment Farm the use of carbon bisulphide has proved one of the cheapest and most effective means of destroying rabbits in the larger burrows. All small burrows should be dug out and refilled so as to destroy as much cover as possible.

The following is the method of application :—

Reduce as far as possible the number of entrances, including the "peep-holes" connected with the burrow to be operated upon. For this purpose a few shovelfuls of earth will generally be found sufficient.

Take a piece of cotton waste forming a ball about an inch and a half in diameter, and saturate it quickly with the liquid and throw it as far as possible into the open burrow.

It should be promptly followed by a lighted wax match, which will rarely fail to cause an explosion which will instantly fill the burrow with the poisonous fumes.

All burrow openings should then be promptly closed with earth. Although the fumes are probably quite as deadly without the application of fire, it is considered that they travel more rapidly after ignition, and the smoke enables vents to be more easily detected.

Great caution should be exercised in handling the liquid under all conditions, as it is highly volatile and explosive. The drum containing the bulk supply should be buried at a safe distance from all buildings, stacks, &c., and the necessary supply for the day should be carried in glass stoppered bottles. No lighted pipe, or fire of any description, should be allowed near the liquid, and cool weather should be chosen for the work. The operator at the burrows should be the only person allowed to ignite the material when it has been placed in position, and the stopper should be replaced in the bottle before the match is lit.

The treatment has always proved most effective, as we have never yet found a treated burrow to have been opened from the inside.

Burrows opened up for test purposes within three minutes after treatment have disclosed numbers of dead rabbits, but never a living one, and rabbits taken from treated tree trunks in which there have been vents have expired within a few seconds.

The price of material is about 5d. to 6d. per lb., in Sydney or Melbourne,

Mixing Rabbit Poison.

The following mixture has always been readily taken even when green feed has been plentiful.

2 sticks phosphorus.	½ oz. ground cinnamon.
3 lb. brown sugar.	16 lb. pollard.
5 lb. molasses.	4 lb. bran.

Place the phosphorus in a pickle-bottle or fruit-preserving bottle which has been previously almost filled with water, and add one tablespoonful of carbon bisulphide. Let it stand for about twelve hours to dissolve the phosphorus; dissolve the sugar and molasses in 5 pints of boiling water, adding the cinnamon, and well mixing the whole.

Make up the liquid to 20 pints, including the contents of the phosphorus bottle, and place it in a large iron tub, gradually adding the bran and pollard, and mixing the whole thoroughly with the aid of a wooden paddle until it attains the consistency of thick cream. The hands may then be used so as to remove all the material from the bottom of the tub, thus preventing any of the phosphorus from remaining there, and so ensuring its complete admixture with the rest of the material. This is necessary to prevent the risk of firing after distribution.

Continue adding the pollard and bran until the mixture reaches the consistency of thick dough, when it will be ready for use.

The material should be laid when it is in a fresh condition, as it is more readily taken by rabbits.

An increase in the quantity of bran will correct any tendency to stickiness, and the inclusion of the cinnamon makes the baits more attractive to rabbits.

Phosphorus should always be cut or broken under water to prevent the danger of ignition.

The quantity of material above described should place baits 2 feet apart over a course of 25 miles.

The use of covering machines is strongly recommended, as if driven by a careful man there is practically no risk to stock, and very few birds are poisoned. Covered baits are more readily taken by rabbits than those which are exposed, as they do not become stale and hard.

Sparrow Poisoning.

G. M. McKEOWN, Manager, Wagga Experiment Farm.

Take 1 teaspoonful of strychnine crystals and 2 pints of wheat. Put them into a vessel with a quart of water and boil until the grain has absorbed the whole of the liquid.

Remove, and when quite dry, strew the grain on feeding grounds frequented by the birds. The best places are those from which grain crops have recently been harvested, or on which it has recently been sown, as the birds are less suspicious when such places are selected.

The Conservation of Soil Moisture.

WILLIAM MACDONALD, M.S.Agr., Dry-Land Agronomist, Transvaal.

THE most important problem in dry-land farming is unquestionably that which deals with the conservation of soil moisture. Hardly a season passes but we hear of crops which have failed because of lack of rain; and this complaint is, unfortunately, not confined to any one particular district, but is more or less common to all parts of the Transvaal. Moreover, this insufficient supply of moisture is due not so much to a scarcity of rain, but rather to its uneven distribution. The average rainfall for the whole of this Colony last year was 23·63 inches, which is a much larger amount—even after allowing for a reasonable amount of waste—than is needed for the production of ordinary farm crops. The practical question is, therefore, "How can we control and conserve the soil moisture so as to save our crops in time of drought?"

Soil Water.

Now, in order to answer this question, we must first understand how the soil holds its water, and the part it plays in the mystery of plant growth. Nor should we forget that the water-holding capacity of any soil is a most important factor in determining the value of farm lands—a matter which, so far as the writer is aware, has not yet been fully recognised in South Africa. It is also important to consider the way in which moisture may be dissipated or lost. In the first place, water, falling as rain upon a field, may be lost by surface runoff, or by percolation in the case of loose, gravelly soil; or, lastly, by evaporating from the surface of the ground. It is plain, therefore, that if by any means we can lessen this loss of water from the soil a larger and surer crop-yield will follow. All farmers are aware of the vast importance of moisture to the growing crop; but perhaps few realise the enormous amount of water that is needed for even a normal crop. Numerous experiments have shown that from 300 to over 500 tons of water are required on the average to produce one ton of dry vegetable matter. In Wisconsin, King found that a two-ton crop of oat-hay required over 1,000 tons of water per acre, which is equal to about nine inches of rainfall.

Again, the amount of water which a soil can hold depends chiefly upon the depth of the soil reservoir and the fineness of the soil particles. That is to say, deep ploughing and the thorough pulverising of the soil are the two factors which enable any soil to hold the maximum amount of moisture. Most farmers in the Transvaal are well aware of the advantages of deep ploughing, more particularly in dry seasons; but some do not yet fully comprehend the

benefit of fining or pulverising the soil. Now, since each individual soil grain is more or less surrounded by a film of moisture, as will be seen hereafter, it is evident that, other things being equal, the largest aggregate area of earth grains will retain the most water per cubic foot. Let us make this plain by a simple sum. Suppose that a cubic foot of marbles one inch in diameter has a total surface of 27·7 square feet. Now, for the sake of argument, reduce these marbles to one-thousandth of an inch in diameter, and you will find that the total area per cubic foot is increased to 37,700 square feet. From this little problem it is clear that the total amount of water capable of being absorbed by a soil which is cloddy aud lumpy must be very small in comparison to that in a finely divided state, and not only is the absorbing power of the soil much less, but its capacity for holding moisture is likewise greatly diminished.

Free Water or Well Water.

It is well known that all fertile soils contain many tons of water which is usually present in three forms as (*a*) free water or well water, (*b*) film water or capillary water, and (*c*) hygroscopic water or water vapour. Let us now see what these terms really mean. Free water is frequently called well water, ground water, standing water, or first water. It comes to the surface in the form of springs, and is usually the source of the supply of wells. If you dig a hole in any ground, you will generally strike water at a certain depth, which may be several inches or many feet below the surface. This point is termed the "water-table." Now the surface of the water-table follows, roughly, the general contour of the land, viz., it stands highest where the ground is highest, and lowest where the land is low. In digging wells, therefore, the farmer must take care to sink the bottom of his well so far below the level of the water-table that seasonable changes will not cause it to go dry. As a recent authority remarks, "We must consider, then, that beneath all farm soils, at some depth, there is standing water, and that we plough and harrow above subterranean lakes." This is a most important fact, because if it is only a matter of one or two feet from the surface of the land to the level of the so-called soil-lake, there is evidently not enough dry soil for the plants to grow and thrive in, and, consequently, they are liable to sicken and die off. The depth of standing water most favourable to crops cannot be definitely stated, since so much depends upon the nature of the soil and the roots of the crop. Thus, whilst lucerne needs a fairly large amount of water to do well, its deep rooting habit renders it undesirable that the "first," or standing water, should be as near as three feet from the surface of the soil, whereas the shallower rooting cereals may be successfully grown with a water-level of this depth. Tap-rooted plants descend to an extrordinary depth in sandy loams, and for such crops a high permanent water-level is not good, since they can obtain their moisture supply at great depths and demand a feeding area vast in comparison with the soil mass at the service of shallow-rooted herbs. Thus lucerne roots frequently penetrate to the depth of twenty feet, and double this distance is not unknown.

Film Water or Capillary Water.

But the most valuable water in the soil, and, at the same time, the most important for the dry-land farmer, is that which surrounds the soil grains in the form of moisture films, and which is also known under the name of capillary water. It is this water which is absorbed by the roots of the plants, and, consequently, forms the direct source of supply of all cultivated crops. If you take a pebble and dip it into a basin of water or into the brook, you will observe a film of water closely sticking to the surface of the stone. This is an illustration of what is termed "surface tension," by means of which water, in the form of moisture films, is held in the pores of the soil particles. The existence of this physical force may be made clear by the simple experiment of floating a carefully-laid clean needle on the surface of water, or by the fact that a drop of any liquid tends to assume the smallest possible space—that is, the shape of a sphere. In short, the free surface of any liquid tends to become a sort of stretched elastic film under molecular attraction; and this is what happens to the soil films under the action of surface tension.

Now, if very fine capillary (from the Latin word meaning a hair) glass tubes are dipped into water, the water will rise up the tubes in inverse proportion to their diameters, or, in other words, the smaller and thinner the tubes the higher will the liquid rise. Again, if the bottom of a tube containing soil is placed in contact with water the moisture will be drawn up one, two, three, or even more feet, depending upon the nature and the fineness of the soil. The movement of film water is usually referred to as "capillary action," and it was formerly supposed that this moisture passed upwards to the surface by means of capillary or hairlike tubes. In reality, there are no such tubes, merely fine passages, pores, or capillary channels, and the film water rises from the sub-soil by means of surface tension. Thus, when the sun is hot, or a drying wind scorches the ground, the soil moisture rises—as oil is drawn up to feed the flame of a lampwick—from the water-table below, which may be two, six, or twenty feet beneath the surface of the ground viz., wherever free or standing water is found. Hall mentions the steady rise of capillary moisture through 200 feet of fine-grained chalk during a dry season in the south of England.

Furthermore, capillary action depends on the fineness of the soil particles and their closeness to each other. In coarse, loose, sandy, or gravelly soils the action is weak; in fine, well-compacted soils it is strong. Thus in the conservation of soil moisture capillarity is a matter of the utmost importance; and, accordingly, in selecting a farm or a portion of a farm for dry-land crops, this problem should be most carefully considered. Most farmers are aware that in a severe drought it is always the crops on gravels and coarse sands, having poor lifting power, which suffer first, since the sub-soil water is with difficulty drawn up to the roots of the plant. Should the drought continue, the clay soils suffer next, for, although they may start with a much larger supply of soil moisture, yet the water moves very slowly through the very

fine pore spaces, and the upward lift cannot keep pace with the loss at the surface due to transpiration* and evaporation.

As Hall† remarks, and the writer's experience bears out this statement, "The soils which are least affected by drought are the deep loamy sands of very uniform texture, fine-grained enough to possess a considerable lifting surface, and yet not too fine to interfere with the free movement of soil water. The western soils which American writers describe as capable of withstanding an unbroken summer drought of three months' duration are deep, fine-grained, and uniform, with practically no particles of the clay order of magnitude to check the upward lift by capillarity." In the Transvaal, in many districts a most casual examination will reveal two types of soil from an agricultural standpoint. The one may be characterised as a shallow, sandy soil, one to three feet in depth, resting upon a gravel sub-soil; while the other is a deep uniform loam from ten to thirty feet in depth. It need hardly be said that the second soil—the deep loam—will remain practically unaffected in dry weather, whilst plants on the shallow soil are wilting, parched, and dying. But the extraordinary thing is that intelligent men will buy farms without the faintest conception of the nature and quality of the sub-soil—a matter which can be readily ascertained, in a few hours, or a day or two at most, by examining cuttings, wells, railroad embankments, digging pits here and there, or by boring with a simple post-hole auger, as well as by taking stock of the growth and depth of the root-system of native trees and shrubs, grasses, legumes, etc.

For the dry-land farmer in the Transvaal, the best "agricultural bank" is surely his depth of soil. And it cannot be too strongly stated that all farmers should make themselves thoroughly acquainted with the character of their soil down to the depth of at least four, but preferably, six to eight, feet. The wisest agricultural chemist in the United States to-day, Professor Hilgard, remarks "that it is hardly excusable that a business man calling himself a farmer should omit the most elementary precaution of examining his sub-soil before planting an orchard or a vineyard, and should at the end of five years find his trees a dead loss in consequence of an unsuitable sub-soil." Again Hilgard says: "Eastern immigrants, as well as a large proportion of Californian farmers, do not realise the privileges they possess in having a triple or quadruple acreage of arable soil under their feet, over and above the area for which their title-deeds call."

Hygroscopic Moisture or Water Vapour.

We now come to the third way in which water may occur in a soil. This is as water vapour or hygroscopic moisture, a term which is derived from the Greek word meaning wet. If you take a tumbler of cold water into a warm room the glass becomes coated with a thin film of hygroscopic moisture produced by condensation. Again, the surface soil absorbs water vapour from the air, and more especially during heavy dews and mists or in cool,

* Evaporation of water from the leaves and stems of plants.
† "The Soil," by A. D. Hall, page 95.

damp nights. Thus it is that in some parts of the world—notably California and Chili—summer fogs have a markedly good effect upon vegetation. And although this moisture is of but little value save in times of severe drought, it is not to be depised by any means. During the hot days of summer a soil of a high absorptive power, such as a well-tilled clay loam, will retain its moisture for a much longer time than a soil of low absorptive power, such as a shallow sandy soil, whose store of moisture will be exhausted in a few hours, while the surface of the land itself is heated up to the scalding point, thereby searing the stems and root-crowns of the growing crop. It is also worthy of note that, generally speaking, soils of high absorptive power are also those of high capillary power.

Hilgard summarises hygroscopic moisture as follows :—

1. Soils of high hygroscopic moisture can withdraw from moist air enough moisture to be of material help in *sustaining* the life of vegetation in rainless summers or in time of drought. It cannot, however, maintain normal growth, save in the case of some desert plants.

2. High moisture absorption prevents the rapid and undue heating of the surface soil to the danger point, and thus often saves crops that are lost in soils of low hygroscopic power.

The Soil Mulch.

Having spoken of the various ways in which moisture may exist in the soil, we now come to a discussion of the best means of conserving this moisture. This can best be done by what is commonly known as mulching. Any material which is spread upon the soil to shade the surface from the sun and to break the connection between the water-bearing sub-soil and the exposed evaporating surface, is termed a mulch. In gardening operations leaves, manure, coarse hay, straw, grass clippings, etc., are commonly used. Such mulches of loose organic material are very effective—even more so than a mulch of fine earth—but they hinder the continual stirring of the land, which promotes aeration and nitrification.* Stones serve practically the same purpose as a mulch, if they happen to be spread thickly upon the surface of the ground, as they shield the land from evaporation and so tend to keep the soil cool and moist. In the bleak, wind-swept county of Caithness, in the far north of Scotland, the writer has known of cases in which the removal of the numerous small pieces of slate and stone—which are often found on the arable lands of that region—has caused a marked decrease in the crop of the ensuing season. Everywhere you may see homely examples of the principle of mulching. Turn over a board or stone lying on the ground; the soil beneath is more moist than the ground near by—for the pores of the earth have been closed, and the current of moisture passing upward has been stopped. That is why fisher lads look for earthworms beneath stones when the weather is dry.

* Process of changing nitrogen into nitric acid and nitrates.

But the most useful and practical mulch in dry-land farming is that which is made of loose dry soil. This is done by stirring the surface of the soil with any implement of tillage such as the plough, the harrow, or the cultivator. Now in closely packed soil capillary water moves freely, and as the surface layer dries under the action of the sun and the wind, fresh supplies of water are lifted from the sub-soil by surface tension, with the result that there is a steady rise of sub-soil water to the exposed and rapidly evaporating surface. In a word, we may think of the sun and the wind as a mighty double-acting force-pump. An American experimenter found that each square foot of an ordinary farm soil, during the summer months, lost 1·3 lb. of water daily by evaporation from the surface of the land, or, in other words, over five inches in a single month. But should the top layer of soil be broken up and left loose upon the land by cultivation, then there is no longer one continuous film linking the exposed surface with the sub-soil water; and, consequently, surface tension can only lift the water so far as the film is unbroken, *i.e.*, as far as the unstirred soil extends, and this layer is protected from evaporation by the loose soil above. That is to say, when a soil mulch is formed the capillary channels are broken and the water cannot rise into the loose layer of surface soil which is separated from the firm soil below by large spaces, across which moisture cannot pass. Accordingly, King writes :—"In the conservation of soil moisture by tillage there is no way of developing a mulch more effectively than that which is produced by a tool working in the manner of the plough—to completely remove a layer of soil and lay it down again, bottom up, in a loose, open condition."

In the humid regions of America, it has been found that a soil mulch of a depth of three inches is sufficient to conserve the moisture of the soil. But in California, and the semi-arid west, fully twice that depth is necessary for proper protection during the dry, hot season, which sometimes last for three to six months at a stretch. This is particularly true of orchard-cultivation in South Africa. For where the cultivation has been shallow—one to three inches—you may frequently observe that the leaves of the trees wilt badly under the hot sun, but recover later on, or during the cool of the night-time, whereas with deep cultivation the trees do not appear to suffer at all, even during the hottest weather. At the same time, in the case of land intended for small grain crops, a three-inch soil mulch is preferable, as otherwise the soil is apt to become too dry close to the surface where the seed germinates, and where the first roots forage for both food and moisture.

SUMMARY.

Summing up, we have seen :—

1. That the first step in conserving moisture is to put the soil in such a condition that it will permit the rain to enter freely, and into a good, deep reservoir.

2. That water exists in the soil as free, capillary, or hygroscopic, but that free water within eighteen inches of the surface is harmful to the growth of

cultivated plants, whereas capillary water is the direct source of their supply, and should be conserved by all possible means.

3. That capillary action depends upon the fineness and the closeness of the soil particles. Consequently, in loose, coarse, sandy, or gravelly soils capillary action is weak, whereas in fine and well compacted soils it is strong.

4. That if the capillary pores in the soil are continuous from the moist sub-soil to the surface, the moisture rises rapidly and passes off into the atmosphere by evaporation. When, however, these pores are made larger near the surface, the upward flow of the moisture is arrested. This can be done by light surface cultivation, which produces a *soil mulch*. But as soon as the soil becomes baked or encrusted the capillary connection with the air is renewed, and tillage is again required to re-establish the soil mulch, and so conserve the moisture in the soil.—(*Transvaal Agricultural Journal.*)

Bonus for Stone-gathering Machine.

The Minister of Agriculture for South Australia offers a bonus of £100 for an efficient stone-gathering machine. The public trial will be held in August, 1909, and entries must be made to the Department of Agriculture, Adelaide, not later than July 1, 1909. The amount of bonus may be allotted in two prizes, but no prize shall be awarded unless recommended by the judges. Machines will be required to remove or gather into convenient rows all stones of not less than 4 in. across their longest axis, and not exceeding 28 lb. in weight. The points that will be considered in judging the machines are:—

1. Efficiency and cost of clearing.
2. Lightness of draught, strength of machine, simplicity of construction and working.
3. Cost of machine.
4. Gathering stones free from soil.

Further particulars may be obtained on application to the Department of Agriculture, Adelaide, South Australia

Artificial Kainit.

KAINIT, as is well known, is a natural potash salt obtained from the Leopoldshall Mines, in Stassfurt, Germany. It is of a definite chemical composition, and contains its potash in the form of sulphate of potash, the amount of this latter being about 23 per cent. Kainit is a neutral salt, and, as such, is freely used by farmers for mixing with superphosphate, sulphate of ammonia, and other manures.

It would appear, however, that, under the name of Kainit, and without any indication whatever that it is other than the natural salt from the German mines, a material is sold which is artificially prepared from sea-weed (kelp), but which, though it may contain the same amount of potash that the natural salt does, has this, not in the form of *sulphate* of potash, but as *carbonate* of potash, the result being that a salt of distinctly alkaline character is produced, and if this be mixed with sulphate of ammonia or other nitrogenous matters, ammonia will be given off, and loss be thereby caused to the farmer who uses it in this way, believing it to be the natural salt Kainit.

It is very necessary, therefore (reports the Consulting Chemist of the Royal Agricultural Society of England), to warn agriculturists against the purchase of this so-called Kainit, a term which it is not right to apply to the artificial product.

This is well illustrated by the following case:—A member of the Society, resident in Kent, sent the Consulting Chemist for analysis a sample of potash salts, of which he had purchased from a local firm 1 ton 12 cwt., invoiced to him as "Kainit," at 47s. 6d. per ton, guaranteed to contain 11 per cent. of potash, equal to 20·35 per cent. sulphate of potash. After analysing this, he reported it to contain:—

Potash ... ... 11·37 per cent.

but he added, "This is not Kainit, but some other form of potash salts, and one that contains a considerable amount of carbonates, which makes its use along with salts of ammonia (*e.g.*, sulphate of ammonia) impossible, as loss of ammonia would result." As the purchaser had intended to use it along with sulphate of ammonia, the warning given was very necessary.

It transpired in the further correspondence that the material was prepared by a company having works in the neighbourhood of London. They accepted all responsibility, and stated that they had manufactured the salt for years past, and had sold it as Kainit. In a circular of the company the material is described as Kainit, without any indication of its origin. On making a complete analysis of the salt, it was found to differ very materially from the

natural salt Kainit, and mainly in the respects that the potash was present not as *sulphate* but as *carbonate,* and that the nature and proportions of the sodium and magnesium salts were very different to those which occur in the genuine salt.

The case seemed one carrying with it such important consequences to the agricultural community who might use the material under the impression that it was the natural salt, that the matter was referred to the Board of Agriculture, with a view to their taking proceedings under the Merchandise Marks Act, for the offence of applying a "false trade description." The Board, however, after a long delay, decided not to prosecute the company, but contented themselves with giving them a warning, and obtaining from them an undertaking that they would not in future apply the term "Kainit" to the manufactured article.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Sub-Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1909.

Society.	Secretary.	Date.
Royal Agricultural Society, Sydney	H. M. Somer ...	Apl. 6 to 14
Mungindi P. and A. Association	C. W. Lowe ..	,, 21, 22
Orange A. and P. Association	W. Tanner ...	,, 21, 22, 23
Narrabri P., A., and H. Association	W. H. Ross ...	,, 27, 28, 29
Richmond River A., H., and P. Society	D. S. Rayner ...	,, 28, 29
Wellington A. and P. Association	A. E. Rotton ...	,, 28, 29
Upper Manning A. and H. Association, Wingham .	D. Stewart, jun....	,, 29, 30
Luddenham A. and H. Society	W. Booth... ...	May 4, 5
Moree P. and A. Society	D. E. Kirkby ...	,, 4, 5, 6
Dubbo P., A., and H. Association	Fred Weston ...	,, 5, 6
Durham A. and H. Association, Dungog	C. E. Grant ...	,, 5, 6
Coonamble P. and A. Association	J. M. Rees ...	,, 12, 13
Kyogle P., A., and H. Society, Kyogle	S. J. Sargent ..	,, 12, 13
Hawkesbury District A. Association	C. S. Guest ...	,, 13, 14, 15
Central Australian P. and A. Association, Bourke ...	G. W. Tull ...	,, 19, 20
Walgett P. and A. Association...	S. Smith	,, 19, 20
Nyngan and District P. and A. Association	....	,, 26, 27
Wilcannia P., A., and H. Society	E. G. Dollmer ...	,, 26, 27
Cobar P. and A. Association	D. H. Dunlop ...	June 2, 3
N.S.W. Sheepbreeders' Association	A. H. Prince ...	,, 30, July 1, 2, 3
Pastoral and Agricultural Society of Deniliquin ...	L. Harrison ...	July 15, 16
Hay P. and A. Association	G. S. Camden ...	,, 20, 21
Balranald P. and A. Society	A. Malcolm ...	,, 28
Peak Hill P., A., and H. Association	J. A. McIntyre ...	,, 28, 29
Narrandera P. and A. Association	W. T. Lynch ...	Aug. 4, 5
National A. and I. Association of Queensland ...	C. A. Arvier ...	,, 7 to 21
Corowa P., A., and H. Association	J. D. Fraser ...	,, 17, 18
Ganmain A. and P. Association	A. R. Bolton ...	,, 18
Forbes P., A., and H. Association	N. A. Read ...	,, 18, 19
Gunnedah P., A., and H. Association...	M. C. Tweedie ...	,, 24, 25, 26
Murrumbidgee P. and A. Association, Wagga Wagga	A. F. D. White ...	,, 24, 25, 26
Parkes P., A., and H. Association	G. W. Seaborn ...	,, 25, 26
Northern A. Association, Singleton	F. A. Bennett ...	,, 25, 26, 27
Grenfell P., A., and H. Association	Geo. Cousins ...	,, 31, Sept. 1
Junee P., A., and H. Association	T. C. Humphrys...	Sept. 1, 2
Lockhart A. and P. Society	H. Parnaby ...	,, 7, 8
Young P. and A. Association	J. F. Dwyer ...	,, 7, 8, 9
Cudal A. and P. Society...	P. Gavin	,, 8
Ariah Park A., H., and I. Association	A. T. White ...	,, 8
Germanton P. and A. Society	James S. Stewart..	,, 8, 9
Cootamundra A., P., H., and I. Association	W. E. Williams ...	,, 14, 15
Albury and Border P., A., and H. Society	W. I. Johnson ...	,, 14, 15, 16
Temora P., A., H., and I. Association	John Clark ...	,, 21, 22, 23
Henty P. and A. Society	P. H. Paech ...	,, 28, 29
Lachlan P. and A. Association	T. Cadill	Oct. 22
Lismore A. and I. Society	T. M. Hewitt ...	Nov. 17, 18, 19
Tweed and Brunswick A. Society	F. A. Wildash ...	,, 24, 25

The Healing of Wounds.

GEO. H. GLOVER, D.V.M.

ANIMALS on the farm are continually being injured by accidents that happen in a thousand different ways. Barb wire cuts are most frequent, and a word or two of advice as to the proper treatment in the hands of farmers will not be amiss. The first thing to gain a correct understanding of a sane and effective method of treating wounds is to remember that nature does the healing, and that remedies applied are simply for the purpose of assisting nature. The right mental attitude in this respect will tend to eliminate a thousand and one nostrums which are tried in rapid succession in the belief that there is somewhere, if it could only be found, a specific remedy with magical influence to bring about the desired recovery in a marvellous way. Mankind has been diligently seeking such remedies for thousands of years and is still keeping up the search. It is time that such a view of the situation, which is based purely upon superstition, should be eliminated, and that we get down to principles based upon scientific research, and instead of groping blindly in the dark seeking the "where," let us always be ready to inquire "why." The ordinary wound will heal of itself if not interfered with. This interference may be from germ infection, parasites, or too much meddling with various applications on the part of man. Now, let us suppose a case. A horse has a badly lacerated leg from contact with a barb wire. The first thing to do, of course, would be to stop the bleeding. This can be accomplished by a tight bandage of clean, white muslin, tied directly over the wound or above it. Often the bleeding artery will protrude, and a thread can be run under it with a needle and the artery tied. Do not use flour, dirt, or cobwebs, or anything of that sort on the wound; they are unnecessary, and may produce a dangerous infection.

Having stopped the bleeding, remove the clots of blood and cut off the ragged edges of muscles with shears. A pan of antiseptic solution should be provided. One of the best and cheapest antiseptics on the farm, good for man or beast, is creolin. Add a teaspoonful of this to a pint of water that has been boiled. Place the knife, shears, &c., in this solution, and wash the hands before beginning. After having cleaned out the wound, wash it thoroughly with the antiseptic solution. See that there is good drainage from the wound at the bottom. Do not allow it to start healing with a pocket that will hold pus. As it is practically impossible to keep a wound on a horse antiseptic, it is not advisable for the farmer to tie up the wound; leave it exposed to the air and apply the antiseptic wash several times a day. Three good antiseptics are, corrosive sublimate, which can be purchased at the drug stores in tablets all ready for use; formalin is good, as is also a

solution of boracic acid. After about a week, it is well to change to dry dressing; a powder composed of equal parts of boracic acid and charcoal and iodoform makes a very good dry dressing. Clean, air-slaked lime, powdered over the wound twice daily, is very satisfactory. The so-called "proud flesh" is only unhealthy granulation. It is seldom advisable for the farmer to interfere with this condition by using caustics; the results are usually disastrous; better in this case to call in a qualified veterinarian. If maggots should get into the wound, a little turpentine or chloroform will help bring them to the surface, where they may be picked out. I did not mention sewing up the wound, for the reason that in case of the ragged barb wire cut it is very seldom worth while to do so. A wound, to heal properly, must be gotten perfectly clean and free from germs from the start, and then kept clean. Remember that it is largely a matter of keeping dangerous germs out and giving nature a chance. Too much interference is often the cause of tardy healing of wounds.

Seasonable Notes.

GEO. L. SUTTON, Wheat Experimentalist.

Smut.

REPORTS show that last year was a particularly bad one for smut amongst the wheat crops. In some instances the crops were so bad as to be unsuitable for the miller; and in at least one instance the crop was practically a failure, because of the large percentage of smutted grains and ears it contained. Because smut was so prevalent last season, many farmers intend to take special precautions against it when pickling their seed this year. These precautions invariably take the form of using a stronger solution of bluestone than usual. Such a plan is to be discouraged. A stronger solution than the standard one (1 lb. of bluestone to 5 gallons of water) is not likely to prove more efficient for destroying the smut spores; but it is likely that the result of using a stronger solution will be that fewer plants will grow from the seed planted, and that those which do grow will be less vigorous.

Because of the increased danger from smut this season the practice of dipping the seed in butts should be discontinued, and the seed should be poured gently into the bluestone solution, so that the unbroken smut-balls can be skimmed off. The extra precautions should consist in making sure that the unbroken smut-balls are skimmed off. With those who pickle their wheat, the great danger of smutty crops next year is from neglect to remove these unbroken smut-balls. The magnitude of the danger, as the result of neglecting to do this, will be realised if it be known that the bluestone solution is powerless to destroy the spores contained in these unbroken smut-balls, and that in any one of them there are sufficient spores, if evenly distributed, to infect every grain in a bag of wheat. Fortunately, these bunt-balls will float on the surface of the bluestone solution, and, with a little trouble, can be skimmed off.

If proper arrangements are made, it is very little, if any, more trouble to dip the grain loosely in the solution than to dip in butts. But, however troublesome, to skim the smut-balls off is the right way, whilst to leave them amongst the wheat, as is done when dipping in butts, is absolutely wrong and dangerous; for, if these smut-balls become broken after the seed has been pickled, their contents are likely to become spread over the treated grain and reinfect it, thus nullifying the effect of pickling, and causing the labour and material necessary for the operation to be wasted.

The experience gained last year indicates that when the practice of supplementing the bluestone treatment with one of lime-water is adopted, it is advisable to allow the wheat, after being dipped in the bluestone solution, to remain for half to one hour before immersing it in the lime-water.

The necessity for thoroughly drying the wheat after it has been treated with bluestone and lime water, so that it will run freely through the drill, is again emphasised.

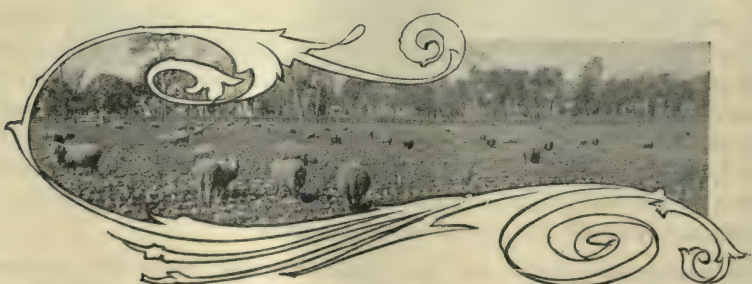
Weedy Land.

The recent general rains will afford those with weedy ground a splendid opportunity to clean it. Such land, if not already ploughed, should be broken up at once and the weeds encouraged to grow, by at once harrowing it down, and then harrowing again after rain. As the weeds grow they should be eaten down, and then, just before planting time, completely killed by thorough work with the cultivators or skim plough. To plough the ordinary depth just before planting is not recommended, as, amongst other reasons, it is likely to bring fresh weed seeds to near the surface, where they will have equal chances with the wheat to germinate. Experience shows that it is far better to plant late, in clean or well-prepared land, than on land which is weedy or badly prepared.

Rape.

It is still seasonable to plant rape. The ground for this crop should be put in good tilth before the seed is planted. To plant in badly-prepared land is to court failure, except in particularly good seasons. The seed of this plant being small, it is unwise to plant it deeply. Many cases of the failures that have occurred are undoubtedly the result of doing this. It is unsafe to plant it much deeper than 1 inch below the surface.

The plan of sowing in drills $2\frac{1}{2}$ to 3 feet apart is again recommended. In addition to the many advantages derived from cultivating the soil between the drills, considerable loss is saved when the crop is being fed off. When the crop is broadcasted, the sheep in travelling over the crop to graze it destroy some of it; when it is planted in drills, they are able to travel between the drills of the crop and graze it without destroying it.



Orchard Notes.

W. J. ALLEN.

April.

Green Manuring.—If this crop is not already in, it should be put in now with as little delay as possible, wherever such crop is to be grown among trees and vines. The soil in most of our fruitgrowing districts has had a fair soaking, and consequently the seed will germinate quickly after sowing.

Planting.—Planting of citrus trees may be continued this month. Where autumn planting is practised care should be taken in handling such trees not to expose the roots to either wind or sun. Those who intend planting out new orchards should get the land cleared and subsoiled as soon as possible, and trees secured. In buying apple-trees see that they are all worked on blight-proof stocks, as trees worked on such stocks can be easily kept free of the woolly aphis.

Refills.—The ground should be well worked up where such trees are to be planted in established orchards, and if the soil is poor or hard it would be as well to remove a load or two of the poor soil, and fill up the hole with good soil if there is any handy. Before filling up with this good soil it would be as well to sprinkle a few pounds of lime in the bottom of the hole. This will assist in sweetening the ground.

Scales on Citrus Fruits.—If there are any citrus trees on which the fruit is dirty, it would be well to fumigate immediately if the trees are in good condition, as, if this work is done now, most of the scale will have fallen off the fruit by the time it is ready to be sent to market. Other States do not want spotted fruit, even though the scale may be dead. It is only those who have clean fruit who will be allowed to market it in New Zealand and the different States of the Commonwealth. Fumigating tables may be had on application to the Department of Agriculture.

Codlin Moth.—Bandages must still be kept on the trees, as, even after all the fruit is removed, an occasional grub finds its way to the bandages. All props should be removed from the orchard, and any grubs adhering to them destroyed.

A solution which finds great favour now is Swift's arsenate of lead, which does not burn the foliage as will the other sprays, and requires no boiling or lime, and has only to be diluted in cold water. Two pounds of arsenate of lead to 50 gallons of water will be found quite strong enough, and the apple trees should be given a thorough spraying just as soon as most of the petals have fallen; then give two later sprayings, at intervals of thirty days. Be careful to cover every part of the tree, and be most careful over the first application to see that it is done thoroughly and every young fruit covered.

District Notes.

Hawkesbury.

H. W. POTTS, Principal, Hawkesbury Agricultural College.

The autumn tints on trees and shrubs proclaim the departure of summer. We are in a good position to carry on farming operations in the most vigorous fashion this month. The rains which fell in February were sufficient to leave the land in excellent condition for cultivation and provide adequate moisture for the rapid germination of the winter crops.

Grass is abundant on all sides, and will afford succulent grazing for stock right into the winter months. The effect of the recent rains is evidenced in the lucerne paddocks from which heavy cuts were taken last month, and the growth shown now promises to provide another heavy cut before the cold weather sets in.

The late-sown crops of maize, sorghum, and millet are now ready to cut and conserve as silage. We are in the position of having ample stores of food for all farm stock through the winter months.

The utmost activity must be maintained to get in the main winter crops whilst moisture and warmth exist in the soil.

Wheats for Green Feed and Grain.—Further sowings may be made of the Durum wheats. The best varieties are Farrer's Durum, Medeah, and Sarragolla. Owing to a deficiency in stooling it is better to sow thickly—from 1 to 1½ bushels to the acre.

For all cereals it is assumed that the land has been well ploughed at a good depth. It will be necessary now to shallow plough 4 or 5 inches, harrow and roll, to secure a fine tilth.

All seed should be treated to avoid the possibility of rust appearing in the crop.

Dissolve 1 lb. of bluestone (sulphate of copper) in 5 gallons of rain water. Place the seed in an open chaff bag and immerse it in the bluestone solution for five minutes. Remove and plunge the bag into limewater from two to three minutes.

Limewater is readily made by adding about 20 lb. of lime to a quarter cask of water, stirring well, and allowing the undissolved lime to settle.

When the grain is required for sowing by the drill it should be exposed for at least twenty-four hours to dry; but if it is to be sown broadcast then it will be dry enough in a few hours.

The quantity to sow per acre when the crop is required for hay is from 45 to 60 lb.

The best hay varieties are Zealand, John Brown, Tarragon, Rymer, Thew, Plover, and Dart's Imperial.

When drilling the seed, ½ to 1 cwt. of superphosphate to the acre may be used as a fertiliser. Drill in at a depth of 3 inches, and harrow immediately afterwards.

When the crop is intended for grain the quantity of seed to use per acre is 30 to 45 lb.

The best varieties for the purpose are Bobs, Federation, and Thew.

Oats.—The methods of cultivation and the treatment of the grain to prevent smut are similar to those applied to wheat.

For green feed the most reliable variety is Algerian. It is also rust resistant. The quantity of seed to sow is 1½ to 2 bushels to each acre with the drill. A suitable fertiliser is ¾ cwt. superphosphate per acre, and where nitrogen is required, ½ cwt. of blood manure.

Another useful variety to sow is the Amarilla (*Arena amarilla Creola*). This variety was originally introduced from the Argentine, and has been tested here for the past four years with slightly better results than those obtained from Algerian. It grows taller, gives a higher yield of grain, but it is slightly coarser in the stem, and resists rust equally well with the Algerian.

The White Tartarian is also worthy of attention, but does not resist rust so well.

Barley.—Extended sowings of Cape barley may be made during the month for green feed.

In order to more closely balance the ration of dairy cattle and provide it with more protein, it is good practice to grow oats or barley in conjunction with vetches or grey field peas. Add half a bushel to the acre.

This combination saves the use of bran or other forms of concentrated foods in stall-feeding.

Rye.—A special advantage in raising this crop for green feed or grain is that it thrives well on any class of soil. The poorest of sandy soils will answer to grow a crop. Any poor class of land on a farm found unsuitable for the growth of other cereals can always be profitably employed in producing rye.

The Emerald variety answers best, but that known as Thousandfold will give good returns.

Sow at the rate of 1½ to 2 bushels to the acre. On very poor soils ½ cwt. of superphosphate may be added to the acre.

Rye is often ploughed in as green manure with a view of increasing the humus content of low-grade sandy loams.

Where it is grown as a grain crop it provides a useful class of food for pigs, and the straw is available for bedding stock in the winter.

Lucerne.—On page 638, Vol. XIX, will be found a full description of this highly-useful plant, with ample directions for its growth and treatment.

Lucerne provides the highest returns at the lowest cost as a stock feed.

This month is the best time to increase the area for this very nutritious and relishable crop.

Turnips and Swedes.—Directions for putting in these crops are given in this issue in the article on Feeding Pigs. Further sowings should be made now. Existing crops require attention in order to keep down weeds and conserve moisture. It is probable that the early crops require thinning.

Rape.—It will be advisable to continue the sowing of rape as a catch crop for feeding sheep and pigs. The soil conditions at present are most favourable for rapid germination and growth. Rape has also been tested with splendid returns as a green manure.

Field Peas.—For green feed the grey field pea suits our local conditions best. They should be sown early in April, in drills, on well-prepared land, 2 feet 6 inches apart. Ten pounds of seed per acre is required. The most suitable fertiliser is 1 cwt. superphosphate, ½ cwt. sulphate of potash to the acre.

Kohl Rabi, Tree-kale, Thousand-headed Kale, and Cattle Cabbage.—These all require to be sown in April in drills 2 feet 7 inches apart, and thinned out to spaces 10 inches from each other, or raised in sheltered beds and transplanted. The land must be thoroughly cultivated, cleansed, and brought to a fine tilth. To each acre may be added 1 cwt. superphosphate. Sow 3 lb. seed to the acre.

Mangolds.—This crop invariably gives good returns here, and is deserving of greater attention. Full details for their cultivation may be seen in the article in this issue on Feeding Pigs.

Sheep's Burnet.—This excellent fodder has never been tested on a scale commensurate with its real worth as a fodder plant. We had ample evidence during the prevalence of the drought period in 1902 to classify this fodder as drought resistant. It is hardy, succulent, and relishable for stock. Once established it lasts several years. It is a deep-rooting plant, and thrives well in any soil, although it may be found to grow best on lands suitable for maize. Five lb. of seed is required to sow 1 acre, and that is best done in drills 18 inches apart. Should it be found most expedient to sow it broadcast, then from 10 to 12 lb. of seed per acre will be required. While the plants are young they need special care in providing light cultivation and moisture until the crop is well established. In all cases the soil must be well and deeply cultivated several months before sowing, with a shallow ploughing just prior to putting in the crop. Weeds must be kept down, and the land clean until the plants are well grown

Pastures.—Advantage might be taken of the favourable season to lay down pastures of prairie, rye, cocksfoot, lucerne, and white clover. The addition of some reliable legume to increase the protein in the grass ration is important. Dependence cannot be placed on the clovers, but recent experience points to lucerne as being the most reliable plant to include in a mixture of grasses for permanent pastures. The Toowoomba canary grass may be sown this month. Sufficient evidence is available to warrant this promising winter grass being subjected to test.

Tree-planting.—Advantage might also be taken of this splendid season to plant out shade and shelter trees for the protection of stock, and the adornment of the homestead. The most useful non-deciduous trees may be planted out this month in suitable spots, such as the pepper, pines, kurrajong, silky oak, camphor laurel, river oak, juniper, American cedar, carob bean, and bunya bunya.

Bathurst.

R. W. PEACOCK, Manager, Bathurst Experiment Farm.

Wheat.—Generally speaking, April is the best month to sow this cereal, and as much as possible should be put in. By sowing early, the plants develop a vigorous root system before the cold weather sets in, which is of great importance if the winter should prove cold and wet. In such winters the root development is much less than when the soil is not soddened by excessive moisture. It is preferable to sow those requiring a lengthy season first; the early maturing varieties could be sown later. At this farm Cleveland is the main variety used for early seeding, and Bobs and Federation are sown later. It is wiser to sow the poorer portions of the farm earliest in the season, as the richer areas are warmer and the growth much greater throughout the winter months. By sowing early less seed is required per acre than if sown late. Less seed is also required when drilled than if sown broadcast. Twenty-five to 30 lb. of well-graded seed, if sown by the drill, are sufficient for the early sowing. These quantities should be increased by 5 or 10 lb. for late sowings. If broadcasted these figures should be increased. The formalin treatment for bunt is one of the most satisfactory. The seed should be sown within a few days after treatment. To ensure the best results graded seed should be used.

Oats can be sown freely this month. They are mostly left until the teams can be spared after putting in the wheat, and perhaps this is the better practice. Wherever practicable, it would be better to sow earlier than is the usual custom, especially if good grain is required. In this district dry summers are the rule; and, generally speaking, the early and mid-season varieties are the best. Algerian is one of the earliest and best. Of the mid-season varieties, Carter's Royal Cluster, Surprise, Peerless White Bonanza, Abundance, and Potato, are most suitable.

Barleys should be sown largely for grain and also for green fodder. They yield large quantities of grain, which is valuable for pig-feed and other purposes. For malting, Standwell seems to suit the conditions of this district best. Malting varieties should not be sown until perhaps the end of the month, or otherwise upon forcing soil they may be injured by a spring frost. For feed grain, Cape and Skinless are valuable, as well as for green fodder. The Skinless does not stand the cold winters as well as the Cape, especially for green fodder. It is earlier than Cape, and for this reason is valuable. They require soils in good condition.

Rye.—This crop thrives upon poorer soils than the other cereals, and is valuable for green fodder. It also withstands very cold weather. For these reasons it is a valuable crop for poor soils and cold districts. It stands grazing well, and is well worthy of more attention as a winter fodder. Black Winter and Arctic varieties are most suitable for early winter fodder; White and Broad-leaved are mid-season varieties. Emerald is the latest,

and it is more suitable for cutting in the spring, at which season it provides the greatest amount of most acceptable fodder.

Lucerne.—This is a very suitable month for sowing this valuable fodder crop. It thrives best upon the rich alluvial soils. It is also a profitable crop for grazing upon the light uplands, upon which it should be grown more extensively. It being a perennial crop, it well repays a thorough preparation of the seed-bed. It is better to sow without a cover crop, as in this district there is rarely sufficient moisture to allow of two crops thriving at the same time upon the same land.

Field Peas and Black Tares.—These are valuable in rotations, and should be grown for this reason, and for stock food. They should be sown early in the month. Black tares are more suitable than the peas for this district. These, in common with scarlet clover, possess the disadvantage of giving their greatest fodder return during the spring when other fodders may be plentiful; their winter growth can in no way compare with rape. Some of the common weeds may mature seeds before these crops can be utilised to advantage. Such is undesirable.

Scarlet Clover.—This should be sown early in the month. In common with the peas and the tares above mentioned, it is a suitable medium by which nitrogen is added to the soil. For this reason, and also its value as a fodder, it is a desirable crop in rotation with wheat and rape.

Linseed.—This crop should receive attention for its seed, such being excellent food for stock. It can be sown throughout the month on well prepared soil, which is in good heart and free from weeds. It does not withstand the dry seasons of this district.

Sheep's Burnet should be sown during the month. It is a deep rooter, hardy, and suitable for light soils. It makes excellent sheep food.

Vegetables.—Transplant onions, Savoy cabbage, broccoli, and eschalots. Plant tree onions, potato onions, and garlic. Sow Savoy cabbage and herbs. Make small sowing of spinach, lettuce, and radish.

Riverina.

G. M. McKEOWN, Manager, Wagga Experiment Farm.

Oats.—The sowing of oats should be completed not later than the end of the month. As for all cereal crops in districts having a light to moderate rainfall, the land should be prepared as thoroughly as possible by deep ploughing and harrowing; and, if necessary for the attainment of a good seed-bed, the land should be rolled before sowing. As a precaution against smut, the seed should be dipped in a solution of 1 lb. of sulphate of copper to 100 lb. water, although, for some reason not yet apparent, treatment in some seasons is ineffectual.

The quantity of seed to be sown should range from 25 lb. per acre, when the crop is intended for grain production, to ¾ bushel when it is intended for hay or feeding in a green condition. For feeding off, those varieties which have a rapid upright growth are the best. They comprise the well known varieties, Tartarian, Abundance, and Danish Island.

Among the successful varieties of more recent introduction are Newmarket, White Horse, Stable King, and White Ligowo, which are white oats of excellent quality, both as grain and hay producers.

For hay, one of the best is the Algerian, which has proved resistant of both drought and rust, thus showing its suitability to a wide range of climatic conditions. Owing, however, to its creeping habit during the first few months of its growth, it is not suitable for feeding off.

Oats are grown only on a limited scale on the Experiment Farm, the blocks detailed below averaging about an acre each, and having a length of over 8 chains. The land was ploughed early in the summer, and allowed to lie fallow. The seed was sown at the rate of ½ a bushel per acre, the manures described below having been drilled with the seed. The soil, which is granitic, was ploughed by rotary disc plough, and well pulverised. The crop was rolled after it was well grown. The total yield from 16 acres, inclusive of the division lanes between the varieties, was 544 bushels of grain and 21 tons of straw.

Following are the yields; the details of rainfall will be found at foot of the notes :—

MANURE COMPARISONS. Variety of Oats—Algerian.

Manure.	Cost per acre.	Yields per acre.			
		Grain.		Straw	
	s. d.	bus.	lb.	cwt.	qrs.
Superphosphate No. 1, 56 lb. ...	2 8	53	4	29	1
Superphosphate, 56 lb. ... Sulphate of potash, 14 lb. ...	4 5	49	37	28	1
Superphosphate, 56 lb. ... Sulphate of potash, 14 lb. ... Sulphate of ammonia, 14 lb.	6 3	54	16	32	1
Shirley's No. 3, 80 lb.	5 8	56	33	35	2
Unmanured	.. ..	40	34	22	1

VARIETY COMPARISONS. Manure—Shirley's No. 3, 80 lb. per acre, 5s. 8d.

		Grain.		Straw.	
		bus.	lb.	cwt.	qrs.
Algerian	....	56	33	35	2
Stable King	....	42	33	30	0
Newmarket	....	39	27	30	3
White Horse	....	40	26	30	0
Big Four	....	25	31	32	3
Colossal	....	34	12	30	1
Danish Island...	....	27	0	30	2
Gold Finder	....	29	10	29	1
Abundance	....	35	13	32	1
Ligowo, White	....	28	17	25	3
Great Northern	....	29	0	18	0
Silver Mine	....	24	20	20	1

Wheat.—The work of preparing land should be proceeded with as rapidly as weather conditions will permit, so that sowing may be completed by the end of May. For hay, an immense advantage is gained by sowing as early as possible before the end of April, thus ensuring, under favourable conditions, the greatest production of straw. For grain, the later sowing, terminating at end of May, is preferable, as the tendency to produce straw is thus decreased. For detailed information as to methods of cultivation, &c., see March *Agricultural Gazette* and *Farmers' Bulletin* No. 2, now available. Information as to varieties of wheat, fertilisers, &c., will be found in the appended particulars of the season's crops at the Wagga Farm.

Barley.—May be sown for green fodder at any time during April. For grain, sowing may commence about the middle of April and continue until the end of May. For further information, see March *Agricultural Gazette* and the appended crop results.

Vegetables.—Sow peas, broad beans, lettuce, cabbage, cauliflowers, and white turnips. Transplant such cabbage and cauliflower plants as are sufficiently forward. For manuring peas, beans, and turnips, use superphosphate in the drills with the seed at the rate of 1 cwt. per acre. For cabbage and cauliflower, stable manure should be well worked in some weeks before planting, and supplemented at planting time by 2 cwt. of No. 3 manure per acre. The fertiliser should be well worked into the soil round the young plants.

Crop Results, 1908.

Wheat.—Paddock No. 6: Ploughed for fallow in October, disc harrowed with double row cultivator twice in January, harrowed in May.

Zealand and Marshall's No. 3, being later varieties, were sown up to May 22, and Federation was sown a few days later.

Seed averaged 41 lb. per acre.

Fertiliser—Shirley's No. 1 superphosphate, at the rate of 56 lb. per acre, was drilled with the seed.

Following are the yields:—

Variety.	Area. ac.	rd.	per.	Yield per acre. bus.	lb.
Federation	6	2	16	29	6
Marshall's No. 3	9	0	12	29	1
Zealand	41	2	20	21	24

Total yield from 73 acres paddock—1,335 bushels wheat and 28 tons 18 cwt. 3 qrs. hay.

Paddock No. 1A.—45 acres red soil.

Previous crop, Skinless barley cut green for silage. Stubbles fed off by sheep. Disc ploughed to 6 inches deep in February; harrowed twice; rolled before and after sowing. Seed sown in April at 45 lb. per acre. Fertiliser drilled with seed, 65 lb. per acre, Shirley's No. 3.

Variety.	Grain yield per acre.	Straw per acre.
Zealand	24 bus. 26 lb.	2 tons.

In similar land, small areas of wheat yielded as follows, per acre :—

	bus.	lb.
Zealand	21	17
Federation	19	12
Marshall's No. 3	18	21
Plover	16	43
Jumbuck	13	36
Firbank	12	11

Paddock No. 5A.—Soil, a grey loam of light texture, and non-retentive subsoil, gravelly in parts. Paddock alternately cultivated and allowed to go to grass. Grass crop, light in previous season, fed off by sheep.

Disc-ploughed 6 inches in April and May; then well harrowed. Rolled after sowing.

Manured with 56 lb. per acre No. 1 superphosphate.

Variety.	Area.	Grain per acre.	
	acres.	bus.	lb.
Federation	30	18	29
Bunyip	6	22	40
Jumbuck	20	16	25
Plover	20	15	19
Comeback	7	14	18
White Lammas	12	12	57

Barley Yields.—Paddock No. 5A. Sown first week in June. Manured as above. The late varieties were injured by hot winds.

	Area.	Grain per acre.	
	acres.	bus.	lb.
Golden Grain	9	22	13
Burton	9	20	11
Binder...	9	20	0
Invincible	9	15	21
Beardless	9	12	24

Paddock No. 4.—Disc-ploughed in January. Previous crop, rape and barley, fed off by sheep. Manure, 65 lb. No. 1 superphosphate. Skinless variety, sown April 27th to 29th. Other varieties, May 19th to 22nd.

	Area.	Grain per acre.	
	acres.	bus.	lb.
Skinless	42	31	3
Kinver	21½	30	28
Giant	6½	24	44
Goldthorp	9½	21	48

Manure Analysis.—No. 1, water soluble phosphoric acid, 16·50–17·40.
No. 3, " " " 13.
Nitrogen, 3·3. Sulphate of potash, 3·7.

Rainfall for previous year, 14·63 inches.

For 1908, the rainfall was 14·84 inches, distributed as follows:—

	Points.		Points.
January	Nil.	July	181
February	219	August	108
March	8	September	320
April	84	October	126
May	69	November	43
June...	303	December	23

Richmond River.

H. R. ALEXANDER, Manager, Wollongbar Experiment Farm.

Winter Crops.—During April the sowing of winter crops, such as oats, barley, peas, rye, &c., as recommended in March *Agricultural Gazette*, should be pushed on with as little delay as possible. It is found that crops for grazing give a much better return when sown early in the autumn. Early sown crops can be fed off two or, perhaps, three times during the winter, and if conditions are favourable, a reasonable cutting of hay may be got from the same paddock by November.

In arranging feeding crops for cows, where possible, it is advisable to divide sowings, say, sow 6 acres towards end of March, another lot by the middle of April, to be followed in a week or two with a further sowing. This cannot always be done, but is to be recommended, as by so doing the supply of green feed will be fairly evenly distributed throughout the winter.

Lucerne.—On the Richmond River, April is the best month for lucerne sowing. Many of the Richmond River flats should grow this king of fodders to perfection. The land should be deeply ploughed and brought to a fine tilth. Sow rather heavily, 15 to even 20 lb. of seed per acre; lightly harrow seed under, using for preference a lever harrow, then roll. Much lucerne seed is lost if sown on rough land and covered deeply. Lucerne sown now will be well established before the season of prolific weed-growth is with us.

Grasses.—Paspalum has apparently taken possession of the "Big Scrub" land of the Richmond River, but even Paspalum has its failings. As a winter grass it is a failure, also a decidedly slow spring grower. To fill this want, trials are being made with various grasses.

Field trials of *Phalaris commutata*, a magnificent winter grower in the plots, have not as yet demonstrated whether this grass will hold its own when grown among Paspalum.

Sowings of prairie, cocksfoot, rye, lamb's tongue, and white Dutch clover are recommended. Given an annual chance to seed, English grasses will hold out for several years in this locality, and give a nice bite of green feed during winter and early spring.

Sow 1 bushel prairie and ½ to 1 bushel of oats to the acre; harrow under at least 2 inches, leaving surface soil fine; then sow 10 lb. cocksfoot, 8 lb. rye, 2 lb. lamb's tongue, and 3 lb. clover per acre. This fine seed will be sufficiently covered by rolling. Grass seed germinates and takes a better hold when sown on a firm seed-bed.

On pasture land where no clover shows among the Paspalum, a light dressing of lime followed with 3 or 4 lb. of clover seed to the acre will be very beneficial.

Vegetables.—The gardener recommends for April and May:—

Sow full crop of peas and broad beans, small sowings of French beans, white turnips, onions, leeks, lettuce, radish, and herb seeds, also smaller sowings for continuation of beet, carrot, parsnip, and cabbage.

Plant out garlic, eschalots, tree onion, and crimson winter rhubarb roots.

Clarence River.

A. H. HAYWOOD, Manager, Grafton Experiment Farm.

Welcome rains early in March came just in time to save very large areas of late maize on the Clarence, and have put the land in excellent condition for tillage operations. The pastures have since made wonderful growth.

Maize.—On this farm harvesting the early maize began 20th January, and the yields so far have exceeded expectations. The crops sown in August caught the needed showers during cobbing stage. "King of the Earlies" yielded 67 bushels per acre, and Early Leaming 80 bushels per acre. The latter variety has proved itself a hardy and desirable early maize for this district.

Winter feed.—The most pressing work on the farm this month will be making provision for winter for dairy and farm stock.

The maize lands occupied by the early crops are now available, and should be ploughed at once, preparatory to sowing soiling or hay crops.

The modern practice of supplying a balanced food for milch cows is to provide combination crops, such as oats and peas, barley and vetches. These can be used green or made into hay. The quantity of seed sown for combination crops is about half that used when each of these crops is sown singly.

Experiments are now in hand to determine which combination (cereal and legume) is best suited to this district.

Wheat for green feed.—Some of the macaroni varieties tried here last year and previous years gave most satisfactory results. The varieties under trial were Medeah, Cretan, Farrer's Durum, Beloturka, and Kubanka. These all did well. Medeah and Farrer's Durum yielded at the rate of 10 tons greenstuff per acre; they all are rust-resistant. If sown now will provide a big bulk of feed about July or August.

Lucerne.—This is about the best month for sowing. Nurse crops are not recommended.

Swedes, Thousand-headed Kale, and Rape may now be sown. The latter will provide one of the cheapest and best foods for pigs.

Vegetables.—During April and May the following vegetables may be sown: Onions, cabbage, cauliflower, peas, and herbs.

North-western Plains.

A. E. DARVALL, Manager, Moree Experiment Farm.

Wheat, Oats, Barley, Rye, and Lucerne may be sown this month—the earlier the better, and should there be a dry spell, the crops should be harrowed with a light harrow as soon as they are up about 3 inches. Last year, from the 27th April until the 11th June, we had only 3 points of rain; and had the surface been allowed to remain hard and crusted, the crops would have been a failure. They were, however, harrowed twice during that period, and came through well. Keep the harrow clean, and practically not any of the crop will be pulled out.

Green Manuring.—Where orchards can be irrigated, green crops for ploughing under in the spring may now be sown. Rye or Field Peas will probably prove to be the best crops for this purpose. Rape cannot be recommended for this district, as it seems to be invariably attacked by aphis. It is doubtful whether it is a wise policy to plant green crops in orchards on black clay soil that cannot be irrigated, as, unless there is a good rainfall in the spring, they cannot be ploughed under, and therefore are not only useless but actually injurious, as they dry out the land, and render it impossible to bring it into a proper state of cultivation.

Vegetables.—Cabbages and cauliflowers should be planted out now, and more seed sown in seed-beds, to provide a succession of young plants. Broad beans, parsnips, turnips, &c.—in fact, any vegetable that will stand frost—may be planted.

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Agricultural Gazette of New South Wales.

Diseases in Stock.

DISEASES OF THE UDDER.

Simple Mammitis, Contagious Mammitis, Specific Mammitis, Tubercular Mammitis, Actinomycotic Mammitis; Sore Teats.

Simple Mammitis.

By this is meant those cases of inflammation of the udder which are not due to any particular organism, and in which the disease is not present in a contagious form. But, in the absence of veterinary advice, the safest plan is undoubtedly to treat all cases as though they might be contagious, unless the cause is an obvious external wound, or something equally manifest. In any dairy herd, cases of mammitis may be expected at any time, and the presence of micro-organisms is certainly an important factor in causing them; but there are many other causes which, by weakening the resisting power of the animal, or exposing a delicate surface to infection, predispose to the disease, and afford the various micro-organisms always present an opportunity to attack the gland. Like all other types of the disease, this may be seen in cows recently calved, or at any time during the subsequent period of lactation, but not in dry cows, except in the form of wounds and bruises.

The most simple form of inflammation is that caused by a wound or bruise more or less severe. This may be caused in many ways, such as horning, the bite of a dog, treading, scratches, and tears on wire and stakes, or blows. A wound only involving the skin requires practically no treatment beyond washing with a little weak disinfectant, but if deeper, and exposing the gland, it should be attended to by thorough washing with 2 per cent. lysol, and 1 per cent. carbolic acid, or other suitable disinfectant—not kerosene or Venice turpentine—and stitching with a little silk or thread, and keeping clean until healed. Bruises should be treated by fomenting with warm water, washing with disinfectant if the skin is at all broken, and the application of carbolised oil—that is, carbolic acid 1 part, oil 40 parts—over the bruised portion. A more extended mammitis is often due to overstocking, bad milking, or sudden and excessive cold. When affected, the udder, or those quarters of it attacked, are hard, red, and painful, the cow often walks with a straggling gait, and the milk is changed in a varying degree to a yellowish fluid, which later may become thick and contain clots. The animal may be somewhat feverish and lose her appetite. The udder gradually becomes larger and may burst if neglected, and discharge pus. If noticed early, the udder should be thoroughly fomented with hot water, and rubbed gently with carbolised oil or soap liniment. The cow should be dosed with

Epsom salts (*Mag. sulph.*), 10 to 16 ounces, according to the size, and an ounce or two of ginger, and milked out as often as possible. If it is neglected, and commences to discharge pus, the treatment given below for contagious mammitis must be made use of.

Overstocking is the term given to allowing a cow's udder to become over distended with milk until the milk is forced out through the teat. Cows in such a state may often be seen at saleyards, the idea being to make buyers imagine the cow's udder to be larger than it really is. This practice is not only extremely brutal and unnecessary, but in many cases gives rise to an attack of mammitis owing to its deleterious action in weakening the tissues.

In some cases a chronic mammitis will follow the original attack. The quarter will become hard and small, and cease to secrete milk. The flow may return after next calving, but more often will not, and once permanently ceased it is impossible to artificially induce it.

Contagious Mammitis.

This form of the disease is essentially one of dairy cattle, and although it has not so far caused serious trouble in this State, it must be regarded as gaining a firm hold in certain districts, and owing to the seriousness of the disease every effort should be made to prevent its spread. It is prevalent in most dairying countries, and of late years has given great trouble in New Zealand. In this form of mammitis predisposing causes may be left out of account, the one and only cause being a micro-organism, the streptococcus of mammitis, which gains entrance by way of the teats. The symptoms in most cases are not very marked, as there is practically no general disturbance of health and very little alteration in the udder. There is often a diminution of milk yield, and the teat duct may feel a little thickened and the quarter slightly swollen and hard, without, however, any pain, heat, or redness.

The quality of the milk very often appears unchanged except for the first quantity drawn away, which may be slightly yellowish. In other cases rather more acute the milk becomes thick and yellowish and resembles pus. If examined under the microscope it is seen to contain numbers of pus-cells and streptococci. If neglected the disease becomes chronic, and often one or more small hard nodules will be found at the base of the teat or in its upper part. These vary from the size of a pea to a walnut, and are known as "pea" or "wart" in the teat. Frequently cows which appeared all right when dried off and turned out come back into the herd with a blind teat or one of these nodules, the reason being that she was infected when turned out, and the disease had since developed. Treatment cannot be said to be very reliable, though this Department has, after trying several other methods with very poor results, been successful with the following:—As soon as a case is noticed the cow is given a dose of Epsom salts (10 to 16 ounces, according to size), the udder thoroughly fomented, and the affected quarter injected with a quarter of a pint of 4 per cent. boracic acid solution. This is made roughly by dissolving an ounce of boracic acid in a pint and a quarter of water and boiling it till dissolved, and is injected by means of an enema syringe, having a teat syphon fixed in place of the nozzle. An even better

mixture, made and used in the same way, is, chinosol 5 grains, boracic acid 6 drachms, and water 1 pint. This treatment is continued twice a day for a week, unless the milk appears fairly normal before that time, when the treatment should be discontinued. To obtain successful results cases must be treated in the very first stage. Care must be taken to boil the teat syphon before and after using. The quarter should be stripped before injection, the fluid left in for about ten minutes, the udder gently massaged, and the fluid withdrawn.

When the milk again appears normal the cow had best be dried off for the season, as it is impossible to tell, without microscopical examination, whether the quarter is wholly free from disease. In chronic cases the best treatment is to fatten for the butcher. In this disease as in so many others, such as contagious abortion, the only reliable treatment is prevention. When a farmer finds that he has contagious mammitis in his milking herd he should at once isolate—that is, put in a separate paddock if possible, and certainly milk in a special bail set apart—all cows affected; he should carefully examine the udders of the other cows, and any which he finds with nodules or thickening of the teat should either be turned out with a calf, fattened for the butcher, or put with the isolated cows. These cows should be milked after the regular herd, and the milk boiled and fed to the pigs; the milker should wash his hands thoroughly in a 2 per cent. solution of lysol, kreso, or other disinfectant after milking each one, and the injection treatment carried out.

The bails and sheds should be given a thorough disinfection with carbolic and the woodwork limewashed, this being repeated every month. In the case of a really severe outbreak it may be found necessary to disinfect the udders of every cow after milking, and to make the milkers wash their hands in disinfectant after milking each cow, care being used that the disinfectant is not strong enough to taint the milk. The disease is usually spread from cow to cow by dirty milkers' hands and dirty milking machine cups; but though this is the most common means of infection it must not be regarded as the only one, for dirty and infected bails may spread it, and in some cases it seems impossible to altogether exclude infected pasture from the sources of danger. By these varied means the disease spreads not only from cow to cow but from one quarter to the other, and when cows suffering from contagious mammitis are sold into other herds, these in turn become affected. To prevent it spreading from herd to herd, cows should not be brought straight into the milking herd, unless it is known that they come from a clean herd, but kept apart and examined thoroughly. The advisability of quarantining new cows brought into a herd from unknown sources cannot be too strongly impressed, although at the present time it is very rarely carried out; it is ridiculous to say that it is much trouble, merely meaning at the outside the erection of a little fencing and provision of a temporary bail with the exercise of some care in milking, while in districts in which contagious abortion, contagious mammitis, pleuro-pneumonia, tuberculosis, and other diseases are present it may be the means of saving a farmer the price

of many cows. In cases in which a farmer suspects contagious mammitis to be present in his herd, he should when possible call in a qualified veterinary surgeon to determine the question for him and advise, and in districts in which no qualified veterinarian is obtainable a sample of milk from the affected quarter should be taken in a sterilized bottle (one that has been boiled), corked and sealed, and forwarded to this Department for examination.

Farmers are often inclined to consider contagious mammitis of little consequence because the individual cows appear so slightly affected; but if they will consider that in some outbreaks half the cows become affected, and most of those have lost one or more quarters, that it is often associated with the specific mammitis described below, and which is very fatal, and that once given a lodgment in the herd it may take months and years to eradicate it they will, perhaps, consider the advisability of "prevention."

Specific Mammitis.

This name has been applied to an extremely acute mammitis which is very frequently fatal. It is characterised by its sudden onset and its rapidly fatal termination. The cow which was in good health when last milked will be brought into the yard badly affected, the udder hot, tense, hard, and painful, the milk changed completely into a clear, brownish, yellow fluid, the cow off her appetite, with a high temperature, often constipated but sometimes suffering from an offensive diarrhœa; the breathing is quickened and the eye dull. The cow gradually becomes worse, goes down and cannot be got up, and may die in forty-eight hours. Should she live longer, the discharge gradually becomes pus-like and she may linger for some days. In cases in which the acute attack is recovered from, she may regain her general health, but the udder remains affected with a suppurating mammitis which may gradually invade the other quarters and recovery from which is practically impossible. Beyond a dose of magnesium sulphate 1 lb., and ammonium carbonate 2 oz., followed by doses of ammonium carbonate, 2 oz., every four hours, and injection of the udder as in contagious mammitis, nothing can be done by the farmer, so that whenever possible veterinary assistance should be obtained at once. If that is not possible the farmer will generally be forced to resign himself to the loss of the cow.

Tubercular Mammitis.

Cases of tuberculosis of the udder are not often seen unless the animal is also affected in other organs as well, but sometimes the first noticeable symptom of tuberculosis occurs in the udder or in the mammary lymphatic glands (kernels) found just above the udder in front and behind. If these become hard and round the case becomes very suspicious, while tuberculosis of the udder may either show a firm painless swelling or a number of irregular hard knobs. The milk secretion is not at first changed, but later becomes thin and bluish, in the last stages becoming clotted. Any case in which there is a hard, gradually increasing lump in the udder must be looked on as suspicious, and other symptons of tuberculosis such as a cough or swelling of the throat glands looked for. That a cow suffering in this way is a great

source of danger, not only to calves and pigs, but to human beings—and especially children who may drink the milk—must be obvious to everyone, as her milk contains large numbers of tubercle bacilli which may infect animals and men drinking it. There is only one proper course for a farmer having such a cow in his herd to pursue, and that is to have her examined by a qualified veterinary surgeon or, failing that, to bring her under the notice of the Stock Inspector or Dairy Inspector at the first opportunity, when the Inspector, if necessary, may test the cow or forward a sample of milk to this Department for examination. It is a distinctly short-sighted policy on the part of the farmer, quite apart from the danger to which he subjects human beings who may use the milk from such a cow, to subject his calves and pigs to infection with tuberculosis by keeping these cows, whilst the practice of using cows with defective udders, which may be tubercular, for raising calves cannot be too strongly condemned.

Actinomycotic Mammitis.

Mammitis, due to invasion of the udder by the actinomyces bovis, may be found either in the form of hard round nodules or as a diffuse inflammation and hardening. Without professional assistance it is not likely to be diagnosed, but the fact that it may occur is a further reason for the necessity of bringing cows with diseased udders under the notice of a veterinary surgeon or, failing that, of a Stock or Dairy Inspector.

Sore Teats.

As a rule, sore teats are due to dirty or careless milking, wounds, or chapping from colds and winds. The safest and best application is probably carbolised oil, that is 1 of carbolic acid and 40 per cent. of oil, but any suitable disinfectant mixed with lard or vaseline to make an ointment will do. The common habit of rubbing them with cow-dung is not only filthy and disgusting but dangerous. The udder should be washed with warm water and a little disinfectant before milking, and the oil or ointment applied regularly directly milking is completed.

COPIES of previous articles of this series in leaflet form may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

So-called Fruit-flies that are not Fruit-flies.

WALTER W. FROGGATT, Government Entomologist.

In answer to a request to the Government Entomologist to be informed which fruit-fly was infesting the tomatoes that the Victorian inspectors were condemning in Melbourne, I received the following official letter from the Assistant Government Entomologist, Mr. C. French, jun. :—

Entomological Branch, Melbourne, 4 February, 1909.

The tomatoes from Sydney this season were absolutely the worst that have come here. Most of them were simply a seething mass of maggots, and according to Mr. Turner (senior inspector of fruit), no less than 3,780 cases were condemned on account of the larvæ of the metallic tomato-fly. Many contained also the larvæ of *Heliothis armigera ;* these two pests are proclaimed under the Vegetation Diseases Act. I have bred fruit-flies from New South Wales tomatoes on several occasions, but not last season. The only flies reared then were the metallic tomato flies, *Lonchœa splendida.*

I have bred one specimen of Mediterranean fruit-fly from tomatoes grown at Hawthorn, Victoria, this season. Other tomatoes were sent by various growers, but only the ordinary metallic flies were bred out. A great number of the tomatoes from New South Wales were rotten on account of metallic fruit-fly larvæ, and would have been condemned as being unfit for human consumption if for no other reason.

As there were a number of reports published in the interstate papers that the Victorian inspectors were condemning our tomatoes because they were rotten with fruit-fly maggots, I therefore think it is about time that it was pointed out that though the metallic green tomato fly *(Lonchœa splendida)* has been placed on the list of proclaimed insect pests in Victoria and New Zealand, and called a "fruit-fly," it would be just as reasonable for those States to place on their proclaimed lists all the "wine" and "ferment flies" that deposit their eggs in decaying vegetable matter.

Lonchœa splendida is not a fruit-fly, and it does not puncture sound unblemished tomatoes ; but as soon as they are damaged by sun or weather cracks, or by the gnawings of cut-worms, or fungus, and when the least decay sets in, this fly deposits its eggs in the damaged tissue.

I have bred it out of damaged potatoes, egg-plant, and tomatoes on many occasions, but it has always been from damaged specimens, and it has never developed from good fruits. Two months ago, Inspector Turner reported maggots as being very bad on the tomato fields at Penrith, and at my request he went carefully through the infested fields, and found that all the fruits that contained maggots were damaged in the first instance chiefly by cut-worms ; and this same state of affairs has occurred always when careful examination has been made in the field. The reason that such a large quantity of Sydney-grown tomatoes were sent to Melbourne in such bad condition as to be "unfit for human consumption" was this: when the heat wave, accompanied by bush fires, swept over the chief tomato-growing districts on the 4th and 5th of January, they left the whole crop more or less scalded and burnt, and the growers had to rush all the least damaged tomatoes into the market before they cut back their plants.

The bulk of these tomatoes should never have been shipped out of the State, and the Victorian authorities were quite right to condemn them as unfit for food; but it is very misleading and unfair to the orchardists of New South Wales to have reports circulated in the Press all over Australia that Sydney tomatoes "are rotten with fruit-fly."

The Metallic-green Tomato Fly (*Lonchæa splendida*, Loew).

This species of fly was originally described by Loew, from Sicily, and was not recorded from Australia until I sent specimens, bred from damaged potatoes, to Washington, United States of America, where they were determined by Coquillet. It is now a well-known fly in most parts of the cultivated districts in Australia and New Zealand. In Van der Wulp's "Catalogue of the Described Diptera of South Asia, 1896," it is not noticed, though four other species of the genus are described by Walker, from Macassar and Ceram. In Schiner's "Catalogue of Diptera, 1860," a number of species are listed, of which *Lonchæa nigra*, Meigen, appears to be one of the commonest. The genus *Lonchæa* was created by Fallon in 1820, when he placed it in the family *Ortalidæ*. Loew raised it to the rank of a family, *Lonchæidæ*; but Williston, in his "Manual of the Families and Genera of North American Diptera, 1896," says, in defining the family *Sapromyzidæ*, "I include in this family the *Sapromyzidæ* and the *Lonchæidæ* of Loew, though the characters are, perhaps, sufficient to justify this separation. The larvæ of *Sapromyza* live in decaying vegetable matter. They are slender, with two distinct mouth hooklets; the entire body, except the anterior segments, is roughened by very small bristles. The segments are distinctly constricted; the penultimate segment with four conical processes in a transverse row, the terminal segment with two three-jointed processes, between which is the cylindrical stigmatic tube. In *Lonchæa* there are no conical processes on the penultimate segment, and the stigmatic tubes, or processes, are small and wart-like." He further defines the groups as follows:—"*Lonchæinæ*.—Tibiæ without preapical bristle; front with a single fronto-orbital bristle; ovipositor flattened and horny. *Sapromyzinæ*.—Tibiæ with a distinct preapical bristle; two fronto-orbital bristles; ovipositor not horny, ending tube-like."

The metallic-green tomato-fly measures about 2 lines (or $\frac{1}{6}$ of an inch) in length, from the front of the head to the tip of the folded wings. The general colour is bright metallic-green, in some instances with blue shades of colour; the space between the eyes is blue-black, with the large eyes of a dull chocolate-brown tint. The coarse bristles scattered over the head, thorax, and abdomen, black; legs also black. The wings are slightly opaque, with deep iridescent tints in the light.

The pupa measures $1\frac{1}{2}$ lines, is elongate-oval in form, with the anterior, or head extremity somewhat pointed, roughened, and blackish, the rest reddish-brown. The anal extremity rounded, with the stigmatic tubes produced into two projecting, blunt, peg-like processes.

The maggot (larva) is dull-white to semi-transparent in colour, elongate, pointed at the head, which is furnished with a pair of retractile black

hooks, or jaws. The body gradually thickened to the anal extremity, which is sharply truncate and ornamented with two circular, flattened, wart-like processes like rosettes; the anterior aperture on either side of the anterior segment behind the base of the jaws yellow and finely-ribbed. Length, 2½ lines. These flies are comparatively common about Sydney, and are easily bred out of damaged tomatoes, but are not often noticed upon the wing.

The Wine-Fly (*Drosophila obscura*, Fallon).

The common wine or vinegar flies, also known in Australia as "little fruit-flies" belong to the now cosmopolitan genus *Drosophila.* This contains a number of species of small reddish brown and yellow flies that swarm round any decaying fruit, other vegetable matter, ferment in wine casks, and even vinegar which is open to the air. In all these materials they deposit their eggs, which develop into the typical slender white maggots with conspicuous black mouth hooks with a pair of prominent posterior spiracles situated on the upper edge of the anal segment, which is flattened, as the maggot, almost pointed at the front of the head, increases in circumference to the tip of the body, which is truncate. These maggots swarm in all such materials and finally pupate in the remains of their food supply. The pupa is enclosed in an oval reddish-brown to yellow shell (puparium) which is about $\frac{1}{12}$ of an inch in length, oval in form, with the breathing tubes on the hind margin of the maggots, produced into small conical projections on the anal segment, and a flattened depression on the upper portion of anterior segments with the cephalic spiracles standing out on the angles.

As soon as decay sets in among the fruit, even in the house, these little flies swarm in, attracted by the smell. They are so common in the summer months, that they get credited with doing a great deal of damage to ripening fruit; yet though they may appear to be the cause of the mischief, close examination will show that the fruit has been first damaged in some other way. The orchardist often describes them as young fruit-flies, because they frequently lay their eggs in the places on the fruit punctured by the tree fruit-flies, from which the adult wine-flies later on emerge. They are on this account often accused of destroying sound fruit. Professor Forbes has recorded an instance in the Transactions of the Horticultural Society of Illinois, 1884, where they were said to be damaging the grape crop, but he pointed out that they were only ovipositing in damaged berries. Austen has given an account of the reputed damage they were said to have caused to hothouse grapes ("Entomologists' Monthly Magazine," 1905).

Howard, in his paper "Principal Household Insects" (Bulletin No. 4, Division of Entomology, U.S., 1902) gives an interesting account of these flies in North America, where about thirty species have been described, chiefly peculiar to the country, though the cosmopolitan species *Drosophila ampelophila* was described from Cuba. He figures the life-history of this species, showing the curious spiny appendage on the first joint of the tarsus on the fore-leg of the male, which under an ordinary lens looks at first like a black spot. He quotes from Comstock's report, 1881–2, that the latter had frequently bred it from apples in the galleries made by the apple-fly maggot (*Rhagoletes pomonella*).

Austen, in an article in the Entomologists' Monthly Magazine, 1905,—"A Dipterous Enemy of English Hothouse Grapes,"—says that in examining the specimens sent to him, he came to the conclusion that the American determination was incorrect, as the English flies were identical with those from America. He says: "Comparison with specimens already in the Museum collection soon showed that the insects belonged to the species well known on the Continent and in the United States under the name of *Drosophila ampelophila*, Loew, which was originally described from Cuba. Further study, however, led to the interesting discovery that (at least as far as can be judged from the description of Mergen, Schiner, and Loew) *D. ampelophila*, Lw., is undoubtedly identical with *D. melanogaster*, Meig., a species recognised as British in the first edition of Mr. Verrall's 'List of British Diptera, 1886.' This synonymy is new."

When at the British Museum last year, Mr. Austen called my attention to this identification of the common "wine-fly," and asked me to examine the species described in my "Australian Insects" under the name of *Drosophila obscura* and see if it was identical.

Our common species, which with other specimens of flies was sent to Mr. Coquillet at Washington for determination, was returned by him as *D. obscura*, a European species described by Fallon from Northern Europe in 1823 and now almost world-wide in its range.

As it is very probable that we may have the two common species in Australia, though all the wine-flies I have examined belong to the latter species, I here point out the chief characters of the two species and append an abridged translation of Schiner's definition of the two species. Austen says: "In length *Drosophila melanogaster* measures from $1\frac{1}{2}$ to $2\frac{1}{3}$ mm.; the colour of the head, thorax, and base of the abdomen is ochreous; the basal half of the abdomen is banded with brown while the apex is shining black or blackish brown. The males are readily recognisable owing to the presence of a peculiar structure at the tip of the first joint of the front tarsus on the inner side."

In length the male *Drosophila obscura* measures about 2 mm.; the eyes are vermilion red, the rest of the head, thorax, under surface of abdomen and legs ochreous, lightest on the undersurface; the upper surface of the abdomen rounded, of a general ochreous colour, with the first three segments banded on the lower edge with black, deepest in the centre, the fourth and fifth segments shining black with the anal segment clouded with blackish brown. The whole insect is clothed with fine bristles and coarser hairs; the wings, semi-opaque, are covered with very fine hairs and the outer margins fringed with longer ones. The curious comb-like structure of black spines on the apex of the first tarsal joint on the foreleg is very distinct. The female, somewhat larger, does not possess this appendage, and instead of having the apical half of the abdomen black, each of the five segments is banded with black and a small dull blackish blotch on either side of the anal segment.

The two species come very close to each other in Schiner's description, besides some distinctive points in the cross nervures of the wing and shape

of the "hind edge cell." He says that the general colour of *D. obscura* is brown, the dorsal surface of the thorax with three rather indistinct darker longitudinal lines, abdomen darker and rather brilliant, face brownish, antennæ blackish, legs rusty yellow, tarsi brown, wings distinctly tinged with brown, bristles on antennæ feathered on both sides. *D. melanogaster*, abdomen quite black—sometimes lighter at the base, rest of the insect rust yellow darkest on forehead and antennæ, wings rather yellowish in tint, bristles on antennæ long-feathered at tolerably long distances apart with their base on the underside bare.

The Yellow Turnip-leaf Miner, *Drosophila flava*, is well known in the turnip fields in England, and though it does not appear to do much damage, except render the plants unsightly, Curtis considers that the decay it often starts may sometimes cause the turnip to be unwholesome food for stock.

Another species, *Drosophila cellaris*, is described by Curtis ("Farm Insects," p. 464), who says: "These are inhabitants of cellars, as their specific name implies, where the larvæ are usually very abundant all the year round. They will breed in stale beer and probably are generated where there is any leakage from the tap and oozing about the bung, as well as from the fungi that spring up round rotten wood in cellars."

The Green-bodied Fly (*Phaonia personata*, Walk.).

In July, 1903, several specimens of this fly were bred out of rotting oranges at Mr. Luke Gallard's orchard at Kenthurst. Since then, on several occasions, we have bred them from decaying fruit sent on to the office from the neighbourhood of Sydney. The eggs had evidently been deposited in the decaying heaps in the orchard.

In general appearance it is like a large house-fly, with the face and thorax covered with fine grey to silvery pubescence with the dorsal surface, the thorax ornamented with four well-defined parallel black lines, which merge together at the scutellum. The dorsal surface of the abdomen, deep metallic blue, clouded with grey. The whole of the under surface, legs, bristles, and finer hairs on the head and thorax black.

The specimens in the departmental collections were examined and determined by Mr. Coquillet, to whom they were sent, as *Phaonia personata*, belonging to the family *Anthomyidæ*.

Walker described this fly under the name of *Anthomyia personata* in the List of Diptera, British Museum Catalogue, Part III., 1849, on page 955. The locality given is simply New Holland, so that it may have been collected in any part of Australia.

The Black Tomato-Fly (*Muscina stabulans*, Fallon).

It is not an uncommon thing to breed out of damaged tomatoes a number of dark-coloured flies, that look somewhat like the ordinary domestic fly.

This has been identified by Mr. Henry Tryon as the above fly, and in his report (Report of the Entomologist and Vegetable Pathologist, Department of Agriculture), Brisbane, 1907–8, he says, "An insect that it was suggested might prove to be an undescribed fruit-fly, and that was reared at

Toowoomba from maggots, closely resembling the larvæ of the members of this group of diptera, derived from tomatoes, proved to be a common domestic species (*Muscina stabulans*), a fly of very wide distribution which had evidently attacked the fruit, when this was mechanically injured, as does the smaller dark green fly *Lonchœa splendida*. The following is Curtis's description of this fly ("Farm Insects," page 462) :—

"*Musca stabulans.*—The male is 3½ lines long, and the wings expand half an inch ; it is of an ash colour, and clothed with black bristles ; the feelers are ferruginous ; the antennæ drooping ; five-jointed and rust-coloured ; pitchy at the base ; third joint elliptical and hoary, except the base ; the seta black and feathery ; basal joint, minute ; eyes large, approximating naked and chestnut colour, the margins silvery white, as well as the face, with a black stripe tapering from the antennæ to the three ocelli on the crown ; thorax hoary, with four black longitudinal stripes before (the two central ones the longest), with a spot on each side, beyond the centre ; scutel hoary, with a dark stripe at the base, ferruginous at the tip ; abdomen, ashy-ochreous, shining, the back variegated with brown patches ; wings with the apical cell not angulated, but suddenly rounded ; scales at the base, with pale tawny margins, and concealing the ochreous-clubbed balancers ; legs black ; apex of thighs and tibiæ ferruginous ; pulvilli at the extremity of foot elongated. Female similar ; but the eyes do not approximate ; the face has a yellow tinge, and the stripe on the crown is broad and elliptical ; the abdomen is broader, with an oviduct at the tail, and the pulvilli are small."

Curtis states that he found the maggots breeding among rotting potatoes.

Several Aspects of the Protection of our Native Birds.

WALTER W. FROGGATT, Government Entomologist.

The writer, from his earliest boyhood, has known and loved the birds and animals of Australia, and no one is more interested, both from an economic and sentimental point of view, in their protection. He hopes to see all the existing Acts simplified, and enforced by some recognised authority. At the same time it is recognised that, unless the people themselves are awakened to the beauty and value of our wonderful bird and animal fauna, no Act, however good, can be of much use.

Nature study is the order of the day ; our children are all being taught the wonders of the wild bush around them. Once let our schoolmasters take up the cause of the "beasties," both great and small, over the length and breadth of the land, and the birds' nests will not be destroyed. We will not see strings of birds' eggs, collected by a misguided student of

nature, festooning the master's study, or the ladies adorning their hats with the more or less grotesquely stuffed skins or heads of birds that have been unfortunate enough when alive to be good looking.

If the fashionable lady, with the heron plumes in her hat, thought o the dead nestlings left to starve to death because their poor mother had some fine feathers on her head, would she wear them for a single day?

There are many side issues in a matter of this kind, some of which I have tried to point out in these notes, and which are not taken into consideration by many people.

The protection of our animals and birds must be carried out in a practical manner, both on a scientific and economic basis; we must know something about the habits of the creatures we are protecting, so that we do not include any species that the man on the land can prove to be injurious.

We would do well to look round and see what is happening in other parts of the world. Though many countries have had game laws in force for hundreds of years, with very drastic punishments meted out to the man who shot the king's deer, as in the good old Norman times in Merrie England, for instance, it was only within quite modern times that such a thing as protecting birds and animals was considered in any other manner.

The first Acts to come into force have always been game laws, not to protect birds for their beauty or use to the community, but that they might increase and breed, so that they would furnish sport to the hunters, who, in some instances, were the wealthy few, who had their sport at the expense of the general public. Later on, game laws were modified on a more honest plan to protect the animals and birds with a "close season," so that they could breed without being molested, for they were recognised as having a cash value as game.

Next came the practical observer, who pointed out that the birds which fed upon insects that destroyed plants, pasturage, and crops must have also a cash value to the man who made his living out of the produce of the land. Then we had the first Bird Protection Acts for the preservation of insectivorous birds, because they destroyed insect pests and other vermin.

The protection of our native fauna must start with an economic basis, not a sentimental one. First, show the man on the land the economic value of the bird or beast; demonstrate that the bird is working for him in devouring destructive insects, or has a value as game, and he will not allow its wanton destruction, and you will need no policeman nor warden to enforce the clauses of the Act. Then let the teacher come along and show our rising generation the beauty of form and colour, the place in the woods and fields of each living creature, and he will soon create the sentimental side of the question, and our birds and beasts will be protected simply because they are birds and beasts and do no harm, but add to the beauty and cheerfulness of the surroundings.

We have in each of the Australian States a more or less comprehensive Bird and Animals Protection Act, each of which, with perhaps a few minor

alterations, is quite sufficient to do all that is required, if it is only enforced. There is very little use in passing an Act of Parliament if there is no machinery to enforce it; and, broadly speaking, all our Bird Protection Acts are dead Acts, because there is nobody whose business it is to carry them out. Like many other things that nobody else wants to deal with, they are passed on to the poor harassed district policeman, who, however willing, has not the time, if he had the special knowledge required, to administer them.

The movement before the lovers of animal and bird life to get the power to have these Acts administered as the framers intended, and further still to have all the State laws dealing with the matter embodied in a comprehensive Federal Act, has now become a necessity. It is only a few years ago that the citizens of the United States arrived at the same conclusion, but their laws were in even a more complicated condition than ours are at the present time, for not only did each State, and there are forty-eight of them, have a different Game and Bird Protection Act within its boundaries, but in some cases several counties of a single State had different regulations and close seasons, so that the unscrupulous pot-hunter could step across the boundary line and kill all he wanted with impunity.

The laws of the United States are considered perfect now, in theory at any rate; but it is not so much from what they are doing now, as what was done in spite of the old Acts, that we can learn some lessons. All their big game, bison and deer in their countless thousands, have vanished off the great plains in one generation. Mr. Mitchell, of Victoria, Texas, who came to the "Lone Star State" fifty years ago, told me that he could remember the time when there were more deer on the prairie than there are cattle at the present time. You have only to take up the works of any of the writers of thirty or forty years ago to read how prolific life was on those rich lands. What has become of the countless millions of the passenger pigeons that used to take their flight every year over the North American forests, and which comprised one of the regular food supplies of the settlers? They are reduced to a few isolated flocks now nesting in the Michigan woods.

When the fashion set in for sea-birds' wings to trim ladies' hats some twenty years ago, there were countless flocks of that beautiful tern known as the "sea swallow" on all the sands and islands from Cape Cod to Southern Florida; to-day there are only two small islands in the north where a few of these birds can be found nesting, and the Government keep paid wardens on these islands for their protection. All the great hosts have been slaughtered for their plumes, to deck ladies' hats. In Southern Europe the treatment of feathered life could not be worse; for the natives of the northern shores of the Mediterranean Sea eat every kind of bird, little or big, that falls into their hands. The Italians construct extensive and permanent trapping-places along the coast, in which, by means of nets and decoy birds, they destroy thousands of the migratory birds coming across from Africa on their way to Central Europe to nest in the summer time.

In the market at Beyrouth, going from Constantinople, the writer saw hundreds of rollers, larks, and swallows plucked and offered for sale; and in

the orchards on the Dog River, beyond the town, every man one met had a gun, and shot at every bird that came in his range. And in our own State what is more common than to see wanton shooting of birds of every kind.

The question then arises, who is to administer an effective Fauna Protection Act? And this question has been answered by the only two great agricultural countries that have taken up the protection in a practical manner—the Kingdom of Hungary and the United States of America.

They have solved the matter by making this necessary protection a branch of the Department of Agriculture; and the officials of the Departments, in conjunction with the officers of the Forestry Departments, look after birds and beasts, and study the many side issues that come up through a more or less artificial condition when absolute protection is enforced. On the 1st of July, 1885, the United States Congress established a section of Economic Ornithology, under the direction of Dr. D. Hart Merriam, to carry out investigations, to include the food habits, distribution, and migrations of North American birds and mammals, in relation to agriculture, horticulture, and forestry. In 1896 this branch became a division, under the broader title of the Division of Biological Survey.

In the offices of this division at Washington there are thousands of stomachs of birds which have been examined and tabulated, so that the food habits can be determined, and their value as insect destroyers or otherwise demonstrated. Maps are prepared showing the migrations and range of the different birds and animals; and, while the protection of useful ones is advocated, the methods of dealing with noxious ones are also closely studied.

The Hungarian Central Office for Ornithology was instituted in 1894, by Count Albon Caaky, Minister of Public Instruction; and, after having been an appendage of the Royal Museum for some years, it was transferred to the Department of Agriculture.

In 1901 Ignácz Daránye, Minister of Agriculture, issued a Circular Decree, which is one of the most complete and well thought-out Bird and Animal Protection Acts in existence.

The writer recently met Dr. Otto Herman, who has charge of the Office for Ornithology, whose untiring energy has made it such a successful movement; for not only does he protect all the useful birds, but he shows the people all through the country their value. A map has been drawn up in which are marked 150 stations, scattered all over Hungary, where professional ornithologists record the migration of as many species as possible; and, besides this, there are 1,300 State foresters, who record the movements of the commoner species.

Artificial nesting-boxes were found so useful to all the birds that nest in holes in trees, that a factory for making them was started; and two years ago (1906) the Minister ordered the Hungarian Central Office for Ornithology to present a scheme to supply these artificial nesting-boxes to the State forests, comprising 5,000,000 acres; and this work is now in hand.

It will therefore be seen that the matter of bird protection on a scientific basis is no new thing, and has received a great deal of attention in different countries.

However, in going into the matter we will find that there are many unnoticed influences to affect the distinctive fauna of any new country like Australia.

There is not the least question that, with the advance of civilisation, when cities spring up, the forest disappears, and where the farmer ploughs the land the natural herbage vanishes, so that the thousands of little creatures, from insects to birds and animals, die out or move on as their food supply fails; for it is not only the gun of the hunter that kills. Now, if you destroy the natural food of any bird or animal, it may, if of an adaptable nature, find some of the crops grown by the farmer or gardener just as suitable for food as the original supply; so that which was under natural conditions, if not useful, at least a harmless creature, now becomes a pest.

The same state of things comes about when, through the destruction of a natural check upon its undue increase, a useful insectivorous bird increases more rapidly than under the original conditions of life, so that the food supply is insufficient. Then the same state of things comes about, and the farmer's crops are affected; so some more damage is done—perhaps not as much as it saves by devouring at the same time pestiferous insects, yet so evident that the practical farmer takes steps to destroy by poison or gun a bird he once looked upon with friendly eyes.

Many years ago, on the northern plains of Victoria, the writer watched this evolution of useful to injurious birds take place in the course of a very few years. When he first went on the land it was subdivided into very large paddocks, in which grazed the squatter's sheep. Then came the selectors under the new Land Acts; the station holdings were cut up into small blocks, and fenced into smaller holdings of 320 acres, or even less.

Under the old regime bird and animal life had not altered much from earlier normal conditions, under which it is quite safe to say that from 25 to 50 per cent. of the eggs and nestlings of the magpies, magpie larks, and numbers of the insectivorous birds fell victims to the hawks, crows, whistling jackasses, and even to our innocent-looking friend the Laughing Jackass.

With settlement came sheep-worrying dogs, and the squatter and selector laid poisoned baits, or poisoned the body of the sheep that had been worried, with the result that the hawks, crows, and other flesh eaters were killed as well as the dogs. Within a few years the increase of the insectivorous birds on the plains was very noticeable; as the ploughman sent his team along turning over the furrow, one would see a whole string of magpies and magpie larks behind him picking up the grubs and worms exposed.

The plough and cultivator brought to hand a fresh, if temporary, increase of food, which meant more nestlings. Then the reaction commenced, the food limit was reached, and one morning the farmer saw the magpies hunting all over the freshly-shooting wheat paddock. At first he rejoiced to see his feathered friends at work for him, probably at a plague of cut-worms or caterpillars. Later on he crossed the paddock and found many young wheat plants pulled up and the soft wheat at the rootlets bitten off. His scientific friend across the creek, to whom he complained, said it was impossible;

magpies would not eat wheat, they were insectivorous; if they had pulled the wheat seedling up it was to get at some grub on the roots. Unconvinced, the farmer a few days later shot a couple of magpies that he had watched at work on his paddock, and on making a rough *post-mortem* examination of their stomachs found the bulk of the contents was composed of the soft spongy wheat grains from the ravished wheat-field.

Then he took action and shot magpies until the survivors flew away in disgust. Since then many thousands of magpies have been shot in both Victoria and New South Wales for this acquired food habit.

Here is another instance of the vanishing fauna: In the Capertee district some years ago the writer was visiting an orchard, whose owner stated that during the last two years he had killed 300 native bears in his trees. He explained that the reason of such an invasion was that the neighbouring land-owner had ringbarked some thousands of acres of eucalyptus forest surrounding his place, and as the gum trees died the native bears had to move on or die of starvation; and as his was the only green spot in the neighbourhood they came there, and climbing about on the fruit trees broke branches and foliage; so they were shot. Only when one knows what a multitude of living creatures take up their home on every old gum tree, can one understand what a change must take place in the ringbarking of our forests.

Again we have several remarkable groups of birds in Australia which have the tip of their tongue produced into regular little camel's hair brushes, so that they can be inserted into the cup-like calyx of the eucalyptus and other honey-bearing flowers, and the nectar thus drawn up into the mouth.

These honey-suckers, belonging to the family *Melophagidæ*, comprise over fifty species of very beautiful birds. Gould says, "They are, in fact, to the fauna what the Eucalypti, Banksiæ, and Melaleuca are to the flora of Australia. The economy of these birds is so strictly adapted for those trees, that the one appears essential to the other; for what can be more plain than that the brush-like tongue so especially formed for gathering the honey from the flower cups of the Eucalypti, or that their diminutive stomachs are especially formed for this kind of food, and the peculiar insects that form a part of it." Yet the very possession of this wonderful mechanism has been the undoing of several groups of the family; orchards have been planted near the forest or in land that once was forest, and the birds investigating found that ripe fruit is just as good as honey, and when dead ripe is just as easily sucked up into the mouth. Every orchardist knows what damage a party of Leather Heads or Friar Birds can do in an orchard of ripe fruit. Then there is the White Eye or Silver Eye, a dainty little bird closely allied to the honey-suckers, and usually considered a useful bird, and in some places called the Blight Bird, for like the Blue Wren they come flying through our gardens in little flocks, creeping through the bushes and picking off the aphis in large quantities in the early part of the year; yet later on they can do quite a lot of damage in a fruit orchard among ripe fruit, and can clean out a ripe pear or persimmon when once they get an opening in the side. The bird lover knows a number of his feathered friends in this doubtful position.

We have the pretty little Rosella parrot, a seed-eater all through the winter months, yet he can do a lot of damage in an apple orchard when once he takes to fruit, and is shot as a pest in many of our southern orchards. Quite a number of the green "keets" are the greatest enemies that the cherry growers have in the North.

Then we have the bee-bird (*Merops ornatus*), and the "wood swallows" (*Artamus*); they are purely insectivorous in their diet, and must kill an enormous quantity of insects, and as the "wood swallows" often come south in the early summer to nest, just at the time when the grasshoppers are travelling in the same direction, they are friends of no small importance to the farmer. But let them come into the bee-keeper's country, and their fondness for honey-bees make them his bitterest enemies.

Returning to the difference, or change, in our fauna produced by the systematic rabbit poisoning, the writer thinks a great many loose statements are made. In the first instance, it is not from the actual eating of the poisoned pollard baits that native birds are killed, but from feeding upon the dead bodies of the poisoned rabbits, and, therefore, it is among the larger carnivorous birds that the death roll is greatest. Many of these destroy eggs and nestlings of quite as useful birds as themselves. No one is more sorry than the writer to see birds of any kind die by such a cruel death as phosphorus poisoning, yet if we could only get some observant bush naturalist to make notes over a rabbit-poisoned area for a year, and note every species of bird dead in the bush (presumably from poison), I think we would get some very interesting data.

When bringing in laws to protect our native fauna we must remember, when dealing with the larger birds and animals, that at one time before settlement the blacks and their dogs were always a balance of power in the increase of wild animals, and the great droughts that passed over the interior were a great factor on over-population of the forest and the plain.

It is only a few years ago since the Victorian Government made a strict close season for the larger kangaroos in the Gippsland forests, yet, the other day, some of the farmers in the protected areas found their crops so badly damaged by the increasing numbers of kangaroos, that they waited upon the Premier and asked that the close season be altered.

At a meeting of the Linnean Society, one member said that it would be a shame if the farmers were allowed to have their way. He but voiced a sentiment, whereas the farmers were practical, and quite within their rights. If a protected bird or animal becomes a pest, owing to this protection, its numbers must be reduced. In the United States, under the game laws, this is recognised, and the shooting, and permission to shoot, in protected areas, so much game per man is regulated by the State authorities and game wardens. In California and Texas, in certain districts, each man of a shooting party can shoot one, two, or three deer, but no more, in the season, while in some States a farmer can shoot animals and birds on his own land as pests, but not outside the boundaries of his farm.

Another speaker on the fauna protection said that it was a disgraceful thing for squatters and farmers to shoot hawks and eagle-hawks because they sometimes killed a lamb. Well, he should have lived on some of the sheep stations in the old days, where the writer has seen forty eagle-hawks round one dead sheep. As well protect crows; yet the answer is given to them by the fact that recently, "at the Gundagai Stock Office, 2,041 crows' heads were paid for at 1s. per head. Altogether, the payments throughout the district will run into several hundred pounds."—*Sydney Morning Herald*, 4th August, 1908.

The emu, that adds such a characteristic touch to the landscape of the Australian plain, has, in sheer cussedness, developed a habit since the advent of sheep into its dominions that has earned for it the dislike of the stockman, who seldom misses an opportunity of destroying its eggs or killing the young ones. This habit is racing about among the lambing ewes, and thus often causing the death of many lambs that get separated from their mothers. The writer once saw about a dozen playing with a mob of mares and foals, and the latter seemed to enjoy the fun just as much as the emus. It is not thought, however, that there is any danger of the extinction of the emu, for with the least protection they soon increase in numbers, and will breed well in captivity.

The old stockowner, looking upon everything that ate grass as a pest, and an enemy of his sheep, civilised the country by destroying it as such. We have in the rising generation a great number of young men who have had the advantages of the higher education, in many cases not obtainable by their pioneer fathers, who are interested in their native land, who need only to have the facts brought under their observation to make them do their best to protect both the fauna and the flora from destruction.

In conclusion, is there not room in this great land for us all—man, bird, beast, and fish—while every man should be entitled to protect his garden and field against "thieves that break through and steal." There are thousands of square miles of forest, plain, and mountain in Australia where wild native creatures do no harm, but add to the beauty of nature, and all useless and wanton destruction of them should be discouraged, if it cannot be stopped altogether.

As before pointed out, however, this can only be attained by educating the people, and showing them the value and interesting habits of the "little creatures of the fields."

Increased Yields obtainable through additional Cultivation of the Soil.

By R. W. Thornton, Government Agriculturist, Cape of Good Hope.

This simple experiment has been carried out for two years in succession. The increases gained from additional cultivation were so remarkable the first season that it was thought that perhaps the cause might be in the land itself, so the plots were reversed this year, and those that gave the heaviest returns last season, instead of being thoroughly worked and reduced to the best mechanical condition possible, only received the usual cultivation, and, true to last year's experiment, gave the smallest yields, whereas those that gave the small yields last season under the usual methods of cultivation have this year given the maximum returns under increased cultivation. This proves conclusively that the increase was *not* due to difference in the soil of the various plots, but to the increased cultivation.

In India, where the peasants often find it difficult to obtain fertilisers and labour is cheap, they depend largely on obtaining good crops by increased cultivation, and will frequently plough their land four or five times. The good results they obtain are amply borne out by the result shown by this experiment.

Last season the experiment was carried out at the Robertson Experiment Station with oats on the following lines :—

The land was uniformly dressed with a complete fertiliser. Each plot received the same quantity of water, including rainfall. After ploughing a cultivator was run over the land and the seed sown with the Superior Seed Drill, and the experiment area was then finally rolled. Each successive plot, however, received one more ploughing than the previous one, and the yields are in steadily ascending order. Taking the cost of each ploughing after the first at 6s. per acre and forage at 2s. 6d. per 100 lb., we have the following returns :—

The actual harvest was very light and quite below normal, but this was entirely due to the ravages of the ladybirds, but as all the plots were affected in a like degree, the results obtained were none the less accurate.

Plot.	No. of ploughings.	Weight of oat hay per acre.	Value of additional oat hay at 2s. 6d per 100 lb.	Cost of additional ploughing.	Clear profit over one ploughing.
		lb.	£ s. d.	£ s. d.	£ s. d.
1.	one.	750	—	—	—
2.	two.	1,000	0 6 3	0 6 0	0 0 3
3.	three.	1,[illegible]80	1 8 3	0 12 0	0 16 3
4.	four.	3,800	3 16 3	0 18 0	2 18 3

This year the experiments were carried out with wheat and barley. The final ploughing and working of the land was commenced on the 15th July, 1908, and completed on the 16th July, 1908. The seed was sown with the Superior Drill, viz. :—

Wheat, at the rate of 60 lb. per acre.
Barley, ,, 30 ,, ,,

The normal dressing of 200 lb. of complete fertiliser per acre was applied to the whole area. Ladybirds were again very troublesome, damaging the barley to a great extent, but as the crop was affected in like degree throughout, this did not interfere with the experiment, except that the yields throughout were far below normal :—

Barley.

Plot.	No. of Cultivations.	Total weight of crop.	Total Grain.	Value of additional grain at 10s. per bag of 160 lb. £ s. d.	Cost of additional cultivation. £ s. d.	Net Profit. £ s. d.
1.	Ploughed once Cultivated ,, Harrowed ,,	1,035	490	—	—	—
2.	Ploughed once Cultivated twice Harrowed once	1,505	635	0 9 0	0 7 0	0 2 0
3.	Ploughed once Cultivated three times Harrowed once	2,125	890	1 5 0	0 8 0	0 17 0
4.	Ploughed once Cultivated four times Harrowed once	2,340	981	1 10 0	0 9 0	1 1 0

Wheat.

At 20s. per bag of 200 lb.

Plot.	No. of Cultivations.	Total weight of crop.	Total Grain.	Value of additional grain. £ s. d.	Cost of additional cultivation. £ s. d.	Net Profit. £ s. d.
1.	Ploughed once Cultivated ,, Harrowed ,,	2,245	617	—	—	—
2.	Ploughed once Cultivated twice Harrowed once	2,350	695	0 7 9	0 7 0	0 0 9
3.	Ploughed once Cultivated three times Harrowed once	2,475	740	0 12 3	0 8 0	0 4 3
4.	Ploughed once Cultivated four times Harrowed once	2,975	825	1 9 0	0 9 0	0 11 9

Here again the cost of the first ploughing was taken at 6s. per acre, and the cost of each additional cultivation at 1s., and, as can be seen by the table, a fair profit was received for each additional cultivation.

The cost of ploughing three or four times, such as was tried with the oat experiment of 1907, was found very costly, when by working the land with a cultivator good results were obtained at one-sixth the cost, and, of course, the time saved by using the cultivator instead of the plough is enormous.—*Agricultural Journal of the Cape of Good Hope.*

ORIGINAL, DRAWN FOR THE AGRICULTURAL GAZETTE.

LEPTOCHLOA SUBDIGITATA, Trin.

Useful Australian Plants.

J. H. MAIDEN,
Government Botanist and Director, Botanic Gardens, Sydney.

No. 103. *Leptochloa subdigitata*, Trin.

Botanical name.—Leptochloa, already explained, p. 307 ; *subdigitata*, Latin, *sub*, having the sense of almost ; *digitata*, Latin, that which has fingers—hence a slender grass with the panicle almost digitate, or spread out like the fingers of a hand.

Synonym.—Eleusine digitata, Spreng.

Vernacular name.—" Cane-grass."

Botanical description (B.Fl. vii, 617).—An erect, rigid, usually glaucous grass, attaining 4 or 5 feet.

Leaves short, with rigid, rather loose, sheaths.

Spikes or panicle branches, six to ten, crowded at the end of the peduncle, with usually one or two lower down, 2 to 4 inches long.

Spikelets 1¼ or rarely 2 lines long, five or six flowered, the rhachis bearing a few short hairs under each glume.

Glumes about ½ line long, obtuse, or almost acute, the outer empty ones usually rather smaller, especially the lowest.

Palea folded.

Grain oblong, perfectly smooth, the pericarp very thin and adnate.

Following is Robert Brown's original description of the grass *Poa digitata*, put in the genus *Leptochloa* by Trinius :—

" Spicis digitatis numerosis, spiculis imbricatis subseptemfloris, perianthii valvulâ exteriore obtusâ trinervi basi subsericea," which may be translated, as follows :—

" Spikes digitate, numerous ; spikelets imbricate, with about seven flowers ; outer valve of the perianth (flowering glume) obtuse, three nerved, somewhat silky—hairy at the base."

Value as a fodder.—A tall tussock-grass, with numerous erect branching leafy stems ; usually met with around dams and river banks, and affording a large supply of coarse herbage (Bailey). I have collected it at Narrabri, and other places, but could obtain no local information as to its value. It is probably a second-class cattle-grass, being stout and strong-growing.

Habitat and range.—Found in all the States, except Tasmania and Victoria. In New South Wales it is found chiefly in the drier parts, *e.g.*, Lachlan River, Darling River, Castlereagh River, Namoi River, Singleton District to Cassilis, &c.

The type came from coastal Northern Queensland.

EXPLANATION OF PLATE.

1. Entire plant.
2. Part of the spike or panicle branch.
3. Single spikelet showing the two outer empty glumes and six flowering glumes.
4. (*a*) Outer glume.
   (*b*) Second glume, both empty.
   (*c*) One of the flowering glumes.
   (*d*) Palea, enclosed in the flowering glume.
   (*e*) Grain, enclosed in the flowering glume.

The Cost of Silage

Mr. C. W. Bowyer-Smijth, of Sutton Forest, writes as follows:—Enclosed is a statement of the cost per ton, and per acre, of a pit of silage just stacked. It occurred to me that, possibly, the figures might be of interest to some of the readers of the *Agricultural Gazette*, especially to those who may be thinking of making silage for the first time. The estimate of weight is, necessarily, only approximate, but I think it will prove to be, when the silage is made, a close one. The stack is now 15 feet high, and when ready for use, it will have shrunk to (say) 11 feet; and the sides of the stack or pit are 22 feet x 20 feet. Allowing 61 lb. weight per cubic foot (actual weight of last year's silage), there should be over 125 tons, but some always inevitable waste at bottom and sides will reduce it to the amount stated, 125 tons.

Much shrinkage has already taken place, as during the stacking it was heavily weighted every night, and also during an intervening Saturday and Sunday, when nothing was done. Weights were logs 12 feet x 9 inches, eight of them being used.

Cost of making Pit Silage.

Area of maize sown—12½ acres.

Number of days harvesting—8.

	£ s. d.	£ s. d.
Rent, 6 months at 5s. per annum	1 11 3	
Seed (Red Hogan), 2½ bushels per acre ...	8 0 0	
Manure and freight, 12 cwt. at 6s.	4 0 0	
Ploughing twice, at 5s. per acre	6 5 0	
Sowing, rolling, harrowing, and cultivating...	1 16 0	
		21 12 3
Harvesting labour—		
1 stacker, at 7s.	2 16 0	
1 cart-filler, at 4s.	1 12 0	
1 do do	1 12 0	
1 dray, horse and cart, at 9s.	3 12 0	
1 cutter, at 6s. 6d.	2 12 0	
1 do at 6s.	2 8 0	
1 carter, at 4s.	1 12 0	
1 do do	1 12 0	
		17 16 0
Total cost		39 8 3

Estimated weight of ensilage, 125 tons.

Cost per ton, 6s. 3d.

Cost per acre, £3 3s. 0d.

Table-land Pasture Grasses and Fodder Plants.

R. H. GENNYS, Manager, Glen Innes Experiment Farm.

THE laying down and preservation of pastures is becoming an important question for the State, and particularly for the table-lands, where, naturally, grasses are scarce in the cold months. How can the growing fat export market be supplied with advantage unless the quality required is forthcoming at the times it is wanted oversea? Any land will not grow good introduced grasses; its situation and quality should be studied as for cereals and other crops. Very sandy, gravelly, or stony land will not suit most varieties, while on the loams and clays most of them do well, some being adapted to one form and some to another. Ill-drained soils are also very unsuitable for producing the sweetest and best varieties; and, although some of fair value grow, yet their quality is deteriorated through being rank and sour. These lands should be drained, and they would also be better limed afterwards.

Draining.—Water-logged lands may be done cheaply with a strong, double-furrow, mould-board plough, followed by a drain-scoop. The drains should have width rather than depth, about 6 inches deep being quite sufficient. The grade should not be too sharp, or the drains may wash into gullies later. They can be easily cleaned out with the same implements when silted up.

Sowing.—The system here advocated is not to sow many pasture grasses together in the same paddock. One grass and, perhaps, one clover with it (but in a small proportion) to each of the several grass paddocks on a mixed farm or station is advocated. This, it is contended, is better for this country than the old English system of sowing many varieties of grasses and clovers in the same paddock. The latter method at first sight appears very attractive, but it is only a matter of a few years when the poorer in quality will overrun the whole, no matter in what proportions the seeds of them may have been sown. How can plants be grown mixed together in sowing, or even separately, in the same paddocks if their constitutions, habits, and qualities are entirely different; for the stock turned in, in many instances, give each the very treatment which upsets the balance of things? Take only two—Prairie and Cocksfoot—in the same enclosure; what happens? The stock will eat the sweet Prairie to its roots, and give it no chance to seed once in the year (which it should be permitted to do), and neglect the Cocksfoot till it has grown coarse, woody, and indigestible. Whereas the latter should be treated in the opposite way, viz., fed down and not allowed to seed for about two years, and, when fed fairly closely, is more nutritious for stock, and is really good in its young stages. The same applies more or less to other grasses. Then there are the heavy stoolers and the light stoolers—one dominates the other; and yet most of the generally-recognised grasses are good under proper treatment.

Feeding off.—Changes are most desirable for stock, and can be obtained under the method advocated here without destroying the rich and more delicate pastures, which can be given the stocking required for their propagation. A rotation of paddocks of grasses might be used with good effect in fattening. For example: the stores may be put on to Rye or Cocksfoot first, and gradually led up to the sweetest, such as Prairie or Lucerne. It is plain that several paddocks must not be stocked the other way—that is, putting the stock from the sweeter to the poorer. Stock that are being topped are very dainty.

Paddocks should not be too large, and in every case should be easily accessible to good water. They should be fed off quickly, to prevent too much treading; and stock should not be put on until the plants are well-rooted, and then calves first, if available, and the sheep and horses gradually. For fat lamb raising the pastures should be succulent and milk-producing all the time.

The feeding-off of pastures in rotation will greatly check the increase of animal parasites; as it will often happen that the newly hatched broods will perish in the absence of rank grass.

One important point must not be lost sight of: Australian soils are not too rich in phosphates, which are constantly being absorbed in the bodies of animals—and especially of young growing stock—from their food, and are not returned to the soil in anything like the same proportions in their droppings as nitrogen and other chemical constituents are. It is, therefore, obvious that many so-called worn-out pastures are suffering from the want of a good top-dressing of phosphates in some shape or form.

Preparation of the Soil.—First plough about 6 inches deep; let it lie roughly exposed to the air for three or four months, to moulder down and sweeten. This applies chiefly to stiff clays. In the lighter soils harrowing every now and then after rains will prevent the moisture absorbed escaping. Prior to sowing stir the land well to a depth of about 3 inches with a light plough or disc cultivator, the latter for preference, the point being to obtain a shallow, lively, and sweet seed-bed for the promotion of quick germination and easily-rooting facilities for young and tender plants, at the same time leaving a firm condition in the subsoil.

Sowing Grass-seeds.—Care must be taken to secure the best quality, and, if possible, those that were harvested from old pastures, so that they may have their perennial nature established. Generally sow grass-seeds rather thickly than thinly on the table-lands, from 20 to 30 lb. to the acre, according to conditions. When clovers are sown, say, 20 lb. grass-seed to 10 lb. clover. This proportion has been used here. Do not sow the two seeds together, as heavy and light will not mix freely, and an uneven distribution will take place. Cross the direction of the cast of the grass-seed with clover, as then any missed spots will be likely filled up. Choose a day with little wind for sowing. If the ground has been dirty, autumn sowing is the best; but in clean, well-worked ground early spring sowing may be practised with a good chance of success. Small grass-seeds, clover, lucerne seeds, and the like

must be covered only very lightly. A bush harrow well used, or very light lever harrows, with the tines sloped towards the driver, will do. The roller may be used to firm the soil underneath, and help get into condition, but the land should be stirred afterwards.

After-cultivation of Pastures receives too little attention. Rolling and harrowing once or twice a year are undoubtedly of benefit to promote stooling and conserve moisture. Cut growths of burrs, thistles, &c., found in pastures at the flowering stage.

Paddocks should be so arranged, if possible, that the sweeter grasses be next the direction from which the prevailing winds blow, so that their seeds, which will not harm the poorer quality of pastures, may be blown that way. It is obvious, if planted in the opposite rotation, harm may be done.

(*To be continued.*)

The Homestead.

In nearly every farming district there are to be observed farm homesteads that gladden the eye and the heart, and others that are most depressing to look at. In practically every part of this prolific land, it is not a question of monetary outlay that governs the difference between a comfortable and beautiful little home and a miserably bare one. It is just a matter of personal taste, and if the old folks will not improve the place in the thousand and one inexpensive ways possible for their own sakes, they certainly should do it for the sake of the little ones. One may often see a settler in the slack time spending hours and hours chopping a rabbit out of a great log, when the same amount of time and energy spent round the homestead would result in paving the way for surroundings of fruitful verdure that people in less favoured parts of the earth would count cheap at any cost. All through the western districts, for instance, a few pine posts set around the cottage, and a few odd lengths of fencing wire, with the timely setting of some grape cuttings that can generally be had for the mere asking, will, in the course of a few seasons, result in the formation of a beautiful shady pergola, hiding the bare plainness of the primary home, and conducing vastly to the comfort of all concerned. To ensure rapid growth of the vines, the ground should be either trenched or deeply broken, and the cuttings, about 15 to 18 inches in length, should be placed in position in June, on the slant, with only one notch above ground. If the ashes from the kitchen fire, in which a few bones have been burnt, can be added to the ground some time beforehand, so much the better. Afterwards the slops from washing day will keep things moving. The posts need be merely pine saplings, about 6 inch diameter at the butt, set, say, 10 feet apart, 15 feet from the walls, and rising to the height of the eaves. It is well to get the posts in position before the cuttings are planted, so as to avoid subsequent disturbance of the roots, but the wiring can, of course, be done as the progress of the vines demand it.

These notes are merely suggestive, and it is felt that on a matter of such paramount importance, many owners of comfortable homesteads will be only too glad to throw out a few hints which can be reproduced for the benefit of those who have not quite realised yet how easily and cheaply the surroundings of the home can be improved and beautified.

Farmers' Experiments.

GEO. VALDER, Chief Inspector.

In order to facilitate the establishment, and for the better control of the farmers' experiments, the Minister has decided that the State shall be divided into five divisions, and that an Inspector shall be appointed to take charge of each division, such Inspectors acting under the direction of the Chief Inspector. The divisions will be as follows:—

North Coast.—Including all that country lying between the mountains and the coast from north of Sydney to the Queensland Border.

South Coast.—The same south of Sydney to the Victorian Border.

Northern.—This embraces all the country lying to the north of Maitland which is served by the Northern and North-Western Railways and Branches.

Southern.—The same south of Moss Vale served by the Southern Railway and Branches.

Western.—The same west of the Blue Mountains served by the Western Line and Branches.

The districts in which experiment plots either have been started, or are being arranged for, are as follows:—

North Coast.—Murwillumbah, Casino, Kyogle, Grafton, Maclean, Wyan and Myrtle Creek, Nambucca, Bowraville, Port Macquarie, Wingham, Taree, Wollongbar, West Maitland.

South Coast.—Wollongong, Dapto, Albion Park, Kiama, Berry, Nowra, Milton, Moruya, Bombala, Cobargo, Bega, Pambula, Rooty Hill, Camden, Moss Vale, Exeter, Robertson, Kangaroo Valley, Liverpool.

Northern.—Delungra, Inverell, Moree, Kelvin, Narrabri, Pilliga Scrub, Wee Waa, Breeza, Gunnedah, Curlewis, Tenterfield, Glen Innes, Guyra, Uralla, Armidale, Tamworth, Quirindi, Singleton.

Southern.—Cooma, Queanbeyan, Albury, Henty, Germanton, Wagga Wagga, Jerilderie, Berrigan, Deniliquin, Yanco, Tumut, Tumberumba, Temora, Cootamundra, Wyalong.

Western.—Gilgandra, Young, Condobolin, Narromine, Mungeribar, Eugowra, Parkes, Grenfell, Wellington, Rylstone, Mudgee, Blayney, Orange, Millthorpe, Cumnock, Cowra, Bathurst.

These are gradually being added to as time permits.

Each Inspector will make his headquarters in a central place in his special division. Under present arrangements these will be as follows:—

North Coast ...	Grafton	Southern ...	Wagga Wagga
South Coast ...	Berry	Western ...	Orange
Northern ...	Tamworth		

It will be the duty of the Inspector to control the experiment plots, and study the requirements of the districts in his division. He will give demonstrations, lectures, &c., in the various centres, and advise farmers generally; in fact in every way in his power foster more advanced methods of agriculture.

In selecting a plot for experiment purposes the following are the chief points observed:—

1. The soil should be of uniform quality and typical of the largest area of soil available in the district.
2. The plot must be centrally situated so that farmers can easily visit and watch the experiments. In every case we endeavour to secure a plot having a frontage to a main road.

3. The farmer experimenting should be capable of carrying out the experiments, and at the same time have the confidence of his fellow farmers.

Also, the rule has been observed, that if possible only one plot should be placed in each district. This was made necessary in consequence of the large number of applications for plots, and the difficulty of controlling more than a limited number. In some cases, however, it has been found necessary to establish more than one plot in a district. For instance, it may be found desirable to experiment in a certain district at the one time with wheat and other cereals, forage plants, and grasses; and in order to give these a fair trial on average land it may be necessary, not only to pick three different classes of soil, but in order to get these, to have the plots on three farms widely separated, hence we get three plots in one district.

The following experiments have been started :—

Wheat and other cereals	60
Forage plants	15
Grasses	25
Potatoes	8
Other crops	11
Total	119

This number is also being increased as fast as the Inspectors are able to extend their work.

The wheat experiments now being sown are confined to comparative trials of varieties and manurial treatment. The following is the plan upon which they are being carried out :—

10 Chains. (left side) — ½ chain (width of plot) — 10 Chains. (right side)

Plot	Variety / treatment
1	Farmers' Variety.
2	Federation.
3	Come Back.
4	Bobs.
5	Farmers' Variety.
6	Bunyip.
7	Florence.
8	Genoa.
9	Farmers' Variety. No manure.
10	Farmers' Variety. 28 lb. superphosphate.
11	Farmers' Variety. 21 lb. superphosphate; 7 lb. sulphate of potash.
12	Federation. No manure.
13	Federation. 28 lb. superphosphate.
14	Federation. 21 lb. superphosphate; 7 lb. sulphate of potash.

Each Plot ½ Acre.

From this it will be seen that there are fourteen plots. The general rule adopted for a variety test is to put, say, six varieties approved by the Department against the best local variety. In visiting the district the Inspector asks the farmers what variety of wheat has given the best results; generally there is a favourite, often either Dart's Imperial or Chant's Prolific, and this wheat is used as the check variety. With the six Departmental varieties the general plan is to select three tried varieties, such as Federation, Comeback, and Bobs for the first trial, and three newer varieties, such as Bunyip, Florence, and Genoa for the second trial, putting a check plot of the Farmers' variety in between these two trials, the same as indicated in the plan plots 1 to 9. This has to vary, however, according to the district, as the varieties given are those used for warm climates, and in the case of a cool climate quite different varieties are sown. The manurial trials last year were confined to simply a test of plot treated with superhosphate against an untreated plot, but this year it will be seen by the plan that an additional plot has been put in which a mixture of superphosphate and sulphate of potash is used, the superphosphate being applied at the rate of 56 lb. per acre, and the mixture 42 lb. superphosphate and 14 lb. sulphate of potash per acre. The reason for this is that up till lately the manurial trials indicated that superphosphate was the only manure which when applied to wheat gave satisfactory results on most soils. During the last season, however, trials conducted at the Experiment Farms indicated that the addition of small quantities of sulphate of potash was decidedly beneficial, and at the suggestion of Mr. Sutton, of the Cowra Farm, this additional experiment was added to the farmers' plots.

The following terms have been decided upon by the Honorable the Minister of Agriculture for the working of Experiment Plots:—

The farmer experimenting finds the land, which should be ready for the plough; and carries out the work of preparing the land, sowing, cultivating, and harvesting the crops.

The Department finds the seeds and manures, and pays for the work of preparing the land, sowing, cultivating, and harvesting the crops.

The Department takes one-third of the resulting produce, and the farmer two-thirds.

In all cases the charges made for the various operations must not exceed the average cost of such operations in the district in which the plot is situated.

In the event of the Department not requiring the third of the produce, the farmer is to take this over at market rates, and the amount will be deducted from his account.

No accounts will be paid till the crop or crops being experimented with shall have been harvested, when the farmer should submit his account in full.

HENRY C. L. ANDERSON,
Under Secretary.

19th April, 1909.

WINTER SCHOOL FOR FARMERS
AT
THE HAWKESBURY AGRICULTURAL COLLEGE.

SHORT COURSES.

THESE are provided for busy farmers and stock-owners (at the slack period of the year) who can devote only a limited time to study and intensive practical instruction. They are thus afforded the opportunity to acquire the greatest amount of directly useful information in the shortest time.

The Winter School Course embraces a variety of subjects, of which it is impossible to take up the whole by one student; but the applicant for admission is requested to state the Courses of Lectures he desires to attend, and the special training he seeks on the farm and other departments.

The Course of Instruction will be continued for four weeks, commencing on the 21st June and ending on 17th July.

Farmers and graziers, or their sons who have worked at least one year on the land, and being over 16 years of age, are eligible for admission, the number, however, being limited to 100. Ex-students of the College are not eligible for admission.

Application for entrance must be forwarded to the Under Secretary, Department of Agriculture, Sydney, not later than 7th June.

Railway Passes will be made available at single fare for the double journey from stations not less than 25 miles from Richmond to all students attending the Winter School, and will be of five weeks' duration. The pass will be obtainable on presenting a certificate signed by the Under Secretary of Agriculture, stating that the holder is a student proceeding to the Hawkesbury Agricultural College, Richmond, to attend the Winter School.

A fee of £2 2s. will be charged for the Course, including board and lodging, &c., at the College. The fee is payable in advance to the Under Secretary.

All students are to be subject to the Regulations now in force at the College.

Each student must provide himself with towels, sheets, pillow-cases, soap, and blacking-brushes.

A syllabus for training and instruction for indoor and outdoor work will be issued in a time-table weekly.

Students will be expected to select such branches of training as may be best suited to the conditions in their own districts and farms.

The College Reference and Circulating Library and the Reading-rooms will be made available for students.

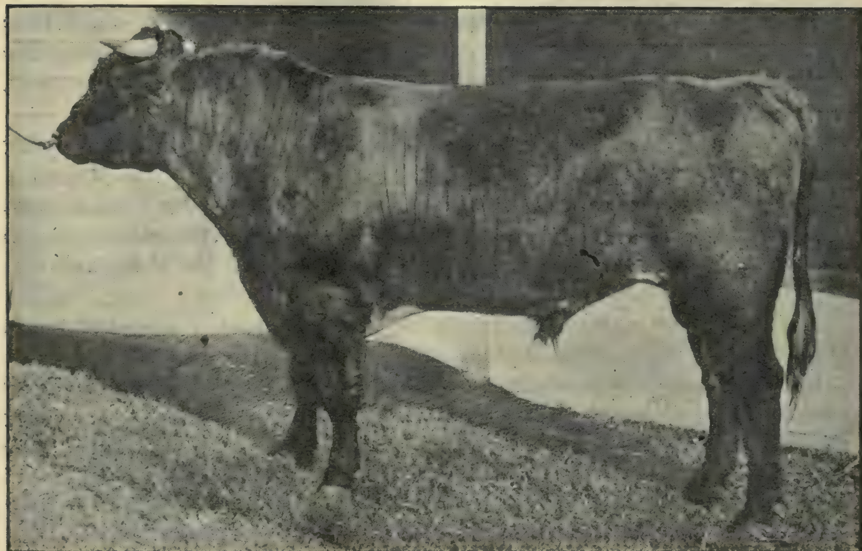
The Gymnasium and Recreation Grounds are well equipped, and can be used by students.

Cattle Exhibits at the Sydney Royal Show.

M. A. O'CALLAGHAN.

BERRY STUD FARM.

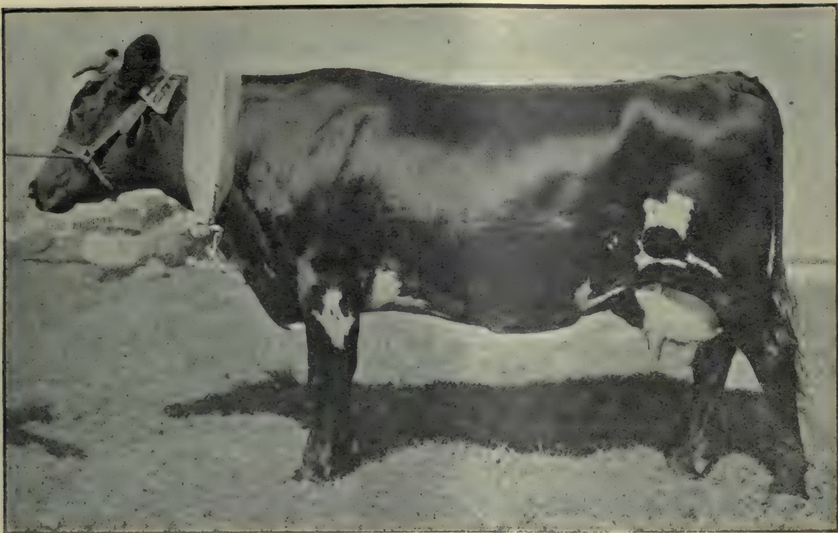
BERRY Stud Farm exhibited in the non-competitive section eighteen animals in all, and the Wagga Experiment Farm made a very interesting and educative exhibit in the shape of a cross-bred Kerry steer and his mother, for the purpose of illustrating the value of the Kerry as an animal to get both milk and beef when suitably mated. This breed is not thoroughly understood by our farmers, and there is no doubt that the present exhibit



1. Royal Hampton (imp.); Government non-competitive exhibit. A young imported bull whose mother resembles No. 2, Mr. Cole's Champion cow.

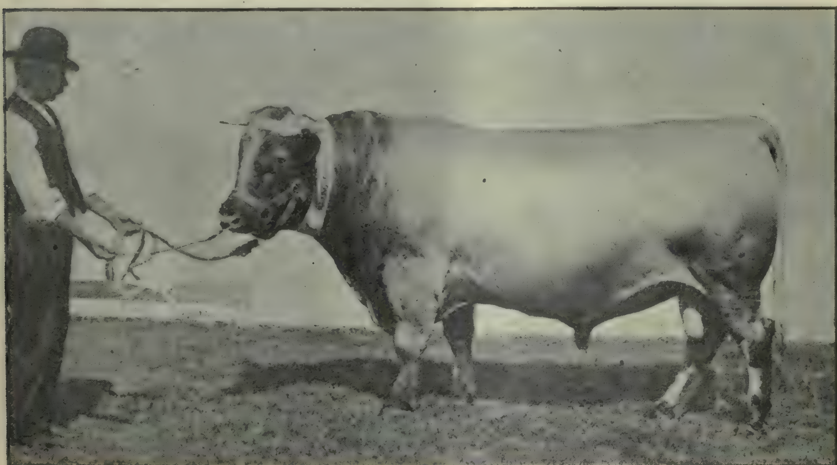
will be the means of arousing attention among a considerable number of pastoralists and dairy farmers regarding the dual properties of this very hardy breed, which should be so highly suited to a considerable extent of light hilly country in New South Wales.

All the dairy breeds of importance were represented in the exhibits made by the Berry Stud Farm, and the well-known Shorthorn bull Dora's Boy was the first encountered on entering the pavilion. This is a beautifully shaped dark red bull, showing a little white on the under line. Although this bull is in the English stud-book he has all the characteristics of the old type of Shorthorn so remarkable for their heavy milking qualities. This bull stands over a good deal of ground but is very symmetrical nevertheless, and his



2. Champion Milking Shorthorn cow, Gold, the property of Mr. Cole, of Jamberoo.

arched thin flank and flat thigh are indicative of the milking characteristics so desirable. He comes of a great milking family, being from the imported Shorthorn cow Lady Dora, an animal that gave on ordinary grass feed 9,560 lb. of milk, or 422 lb. of butter, in a milking season. His sire was the imported bull Cornish Boy, an animal that when he arrived here was condemned by many as the worst of the four Shorthorn bulls then imported from a dairyman's point of view, but, as a matter of fact, he turned out to be the best, and many of his heifers on the Richmond River have passed into the herd-book on their merits.

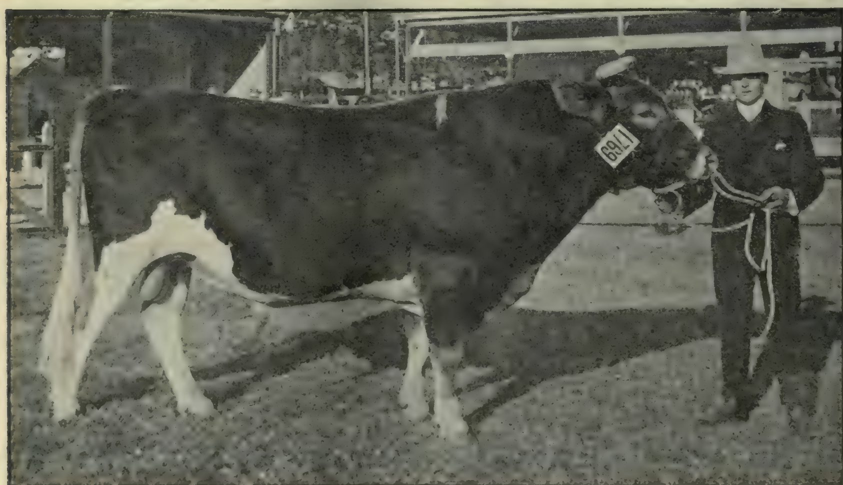


3. Champion bull in Milking Shorthorn class—Sunny Vale—the property of Mr. Warden, of Ulladulla.

4. First prize (in class) Milking Shorthorn bull, Albion, bred by Mr. Williams, Taro.

The next stall was occupied by the recently imported milking Shorthorn bull Royal Hampton 10th, by Solomon, from Orange Blossom. This three-year old bull is a very rich roan in colour, with a beautiful top line. The gentleman (Mr. Guthrie) who selected him described his mother as being very like Mr. T. Cole's celebrated champion Shorthorn dairy cow Gold.

The Jersey bull Sir Jack occupied the third stall. He is one of the pets of the Stud Farm, being considered by the manager as the best of his breed in the country. He is by Omelette's Pride from that wonderfully good cow



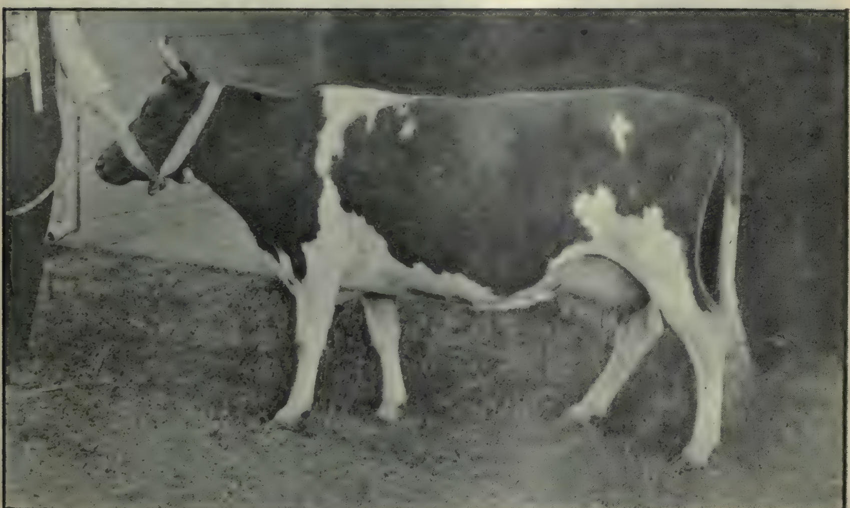
5. Guernsey bull Golden Standard (Imp.), 1st and Champion.

6. Guernsey cow, Vivid 2nd; Government non-competitive exhibit.

Lady Tidy III (imp.), who though in her fourteenth year is as robust as a five-year old.

Omelette's Pride, sire of Sir Jack, is from that very heavy milker and good show cow Rum Omelette (imp.). This young bull has also for grand-dam the imported cow Lucy's Pride, who was herself a winner at London Dairy Show in the milk and butter tests. Lady Tidy has given 334 lb. of butter in an ordinary milking period on grass feed only.

Another Jersey bull exhibited was the youngster Berry Melbourne, by Melbourne (imp.), from Rum Omelette (imp.), and thus a relative on the



7. Clatford Richesse (imp.); Government non-competitive exhibit.

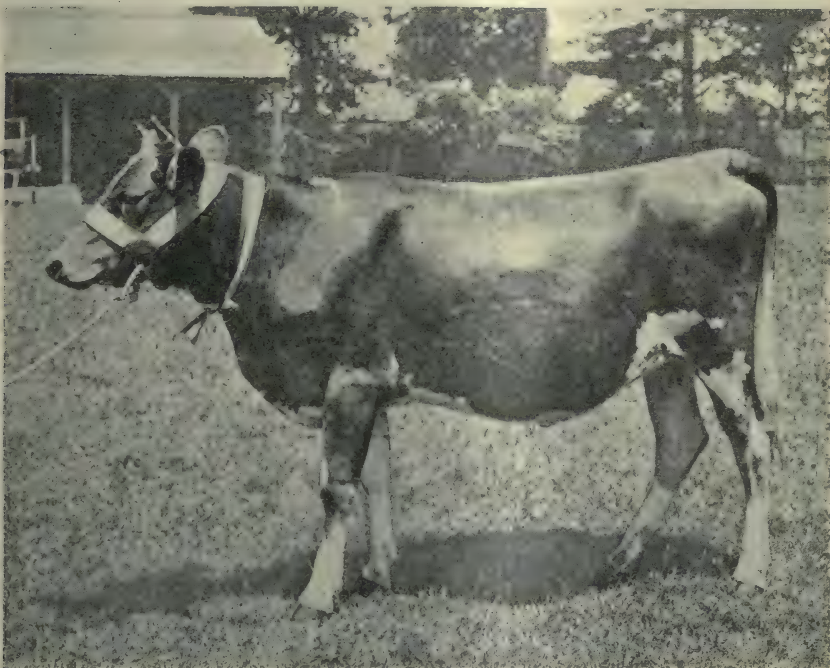
8. Guernsey bull—Kinross Bros.'—Prince of Peace, 2nd prize and Reserve Champion.

9. Guernsey bull, Morton Signet 2nd, bred by Mr. S. Browne.

dam side to Our Jack. This bull is only two and a half years of age, and is a very lengthy young beast that is going to develop into one of the big robust Jerseys we require so much here. His dam gave 6,070 lb. of milk which yielded 332 lb. of butter in a milking period.

Guernseys.

This is the breed represented by the greatest number in the State exhibit. It is a breed that the Government is paying considerable attention to, owing to the great demand for Guernsey bulls by farmers both for purchase



10. Messrs. Kinross Bros.' 1st prize heifer (Guernsey) and Reserve Champion.

and lease, which latter demand is due to the remarkable yields obtained from animals by Guernsey bulls from pure and grade Shorthorn cattle. The aged stud bull Calm Prince, by Rose Prince (imp) is not exhibited, but he is well represented by that very handsome young bull Monsieur Beaucaire, and is by Calm Prince from that great cow Flaxy (imp.), who in a short milking season gave 6,440 lb. of milk which made 334 lb. of butter, with ordinary grass feed, and in connection with this it should be remembered that these cows are not prepared for heavy milk yields, for the simple reason that, as soon as it is possible to get them in calf they are put to the bull, and therefore their milking season is always a short one.

11. Champion Holstein bull, Edinglassie, and cow. The property of Mr. A. Lamond, Illawarra.

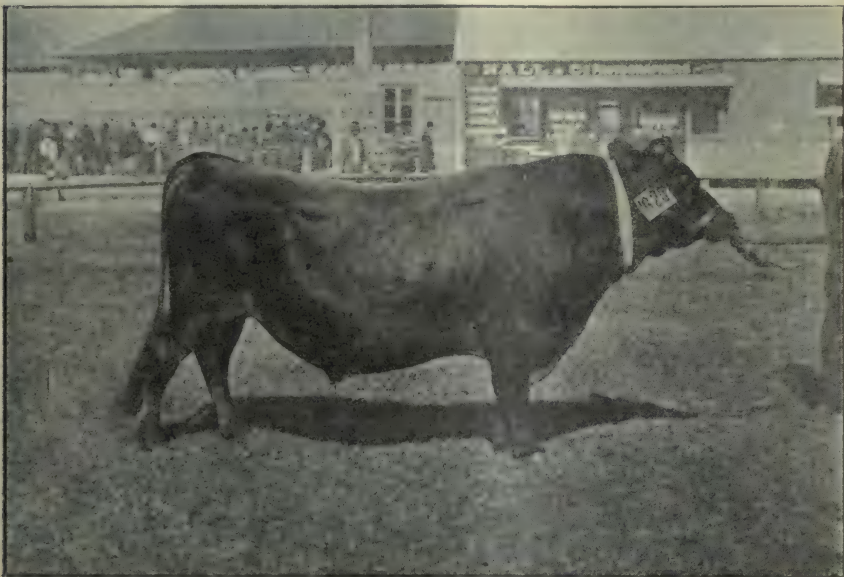
Five Guernsey females were shown, two of which are imported, and three are the result of breeding on the Berry Stud Farm. One of the latter is the daughter of the celebrated cow, Vivid (imp.). She is named Vivid II, and if she is even nearly as good as her mother, the State will be considerably benefited by her progeny. This young cow is half-sister to that very popular sire, Admiral.

The last Guernsey importation is represented by Clatford Richesse and Beatrice XIV. Both these young cows are Island bred, and though not so

12. Sir Jack, by Omelette's Pride, from Lady Tidy 3rd (imp.); non-competitive exhibit of Berry Stud Farm.

robust nor so big as those bred in this State, they are nevertheless of full quality, and should throw some fine progeny to a vigorous large bull like Calm Prince.

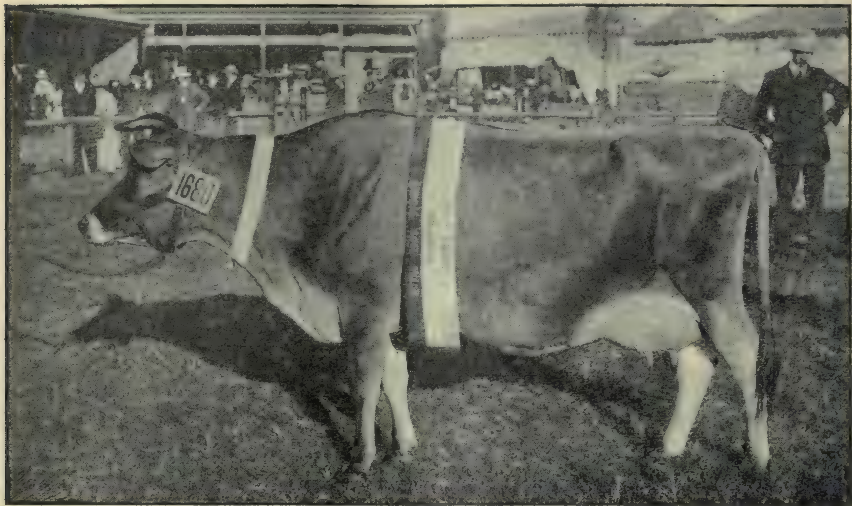
Perhaps the greatest contrast which can be evidenced by surroundings, climate, &c., is shown when one compares the young cow, Flaxy II, with the foregoing. Flaxy II is herself from a very big robust cow, namely, Flaxy (imp.), by Rose Prince (imp.), and having been brought up on good country, she is of the robust type, in fact too robust to please Island judges, but this extra robustness is what we require here where we are breeding wholly and solely for results rather than endeavouring to keep up to the deer-like beauty which the Channel Island breeds possess in their own home.



13. Champion Jersey bull, Brighton King.

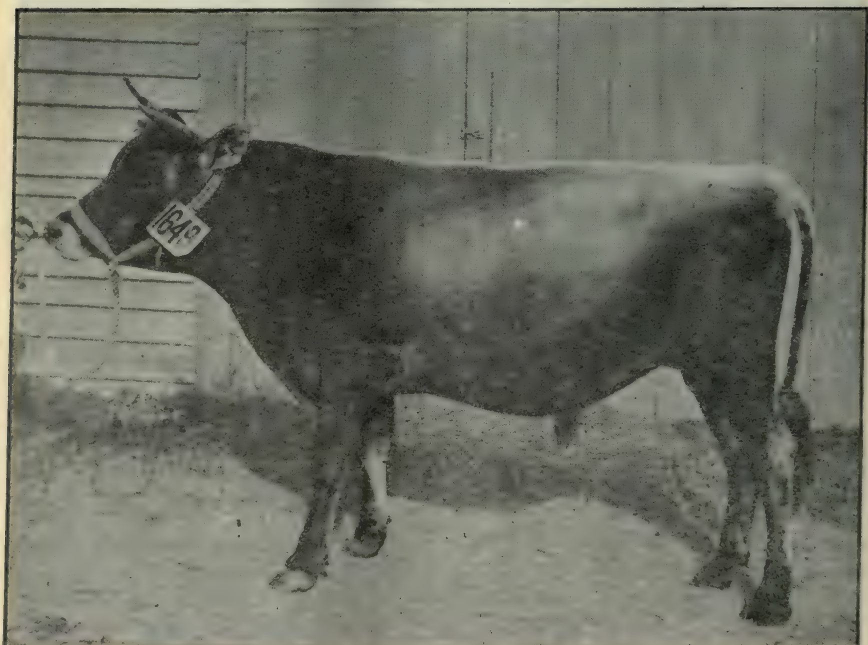
The Holstein breed was represented by Cheddar Lad, a growing young bull by The Hague, from Maggie Obbe (imp.), and it would be impossible to get a strain better descended for milk, as on one side he goes back to Margaretha (imp.), the cow that gave 10,904 lb. of milk in a season, which yielded 407 lb. of butter, and on the other side he goes back to Lolkje Veeman, a cow that gave 9,078 lb. of milk in a season, which yielded 406 lb. of butter. This fine bull has been sold to Mr. Honey, of Kiama.

The Ayrshire breed was represented by two very typical bulls, one brown and white, the other lemon and white, named respectively Sir Thomas and Royal Stuart. Royal Stuart is a grandson of Champion Jamie of Oakbank, being by Jamie's Ayr, one of the best Ayrshire bulls in Australasia, out of Rose Berry, who on her first calf gave 5,799 lb. of milk, yielding 281 lb. of butter. Sir Thomas had for sire Daniel of Auchenbrain (imp.), one of the



14. Champion Jersey cow, Leda's Snowdrop (imp.).

best Ayrshire bulls to beget milkers brought into the State, and on the maternal side runs back to Judy IX (imp.), a cow that gave 6,937 lb. of milk, or 309 lb. of butter, in a season on ordinary grass feed. This young bull was sold to Mr. Jackson, Cudgen, Tweed River.



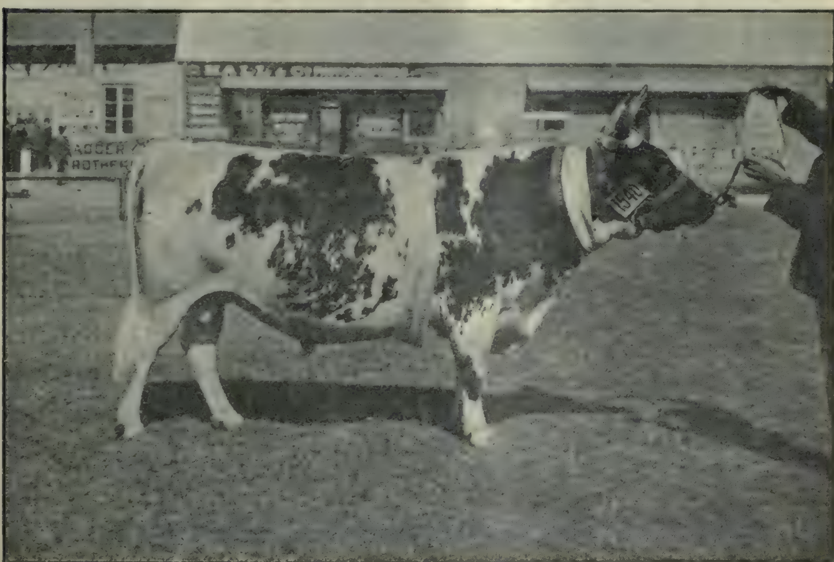
15. Jersey bull, Gypsy King II. A promising youngster exhibited by Messrs. Hyam, of Nowra.

16. Two young Jersey bulls exhibited by Stud Farm Berry. Tidy's Hero on left, and Milkman on the right.

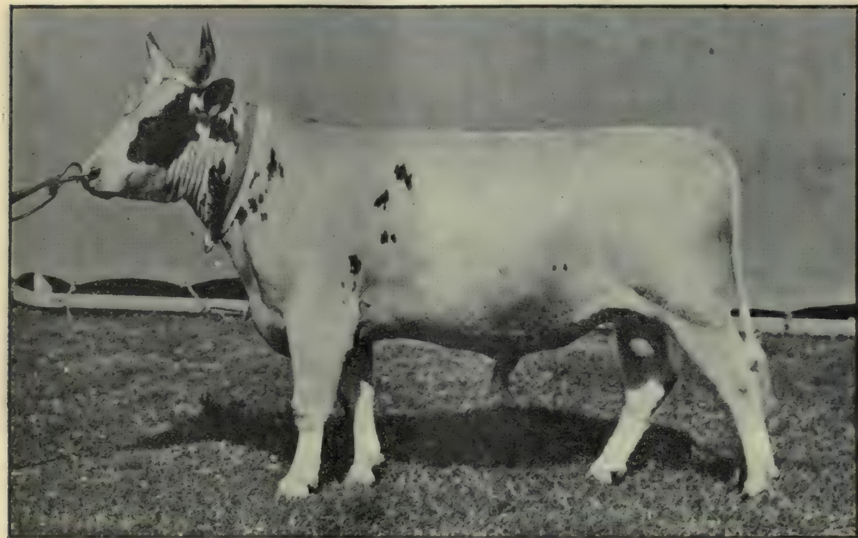
Among the other animals exhibited are two young Shorthorn bulls, Favourite March and Cupid.

Favourite March is by March Pansy, from Favourite, whose dam is that noted cow Fanny LXXVIII (imp.). He was purchased by Mr. Brown, of Orange.

Cupid is by Dora's Boy, out of Heartsease. Dora's Boy has for grand-dam on the sire's side Lady Dora (imp.), whose milk yield for a season on ordinary



17. Champion Ayrshire bull, Glen Elgin Philanthropist. A fine brown and white animal, of good head and horn, and great constitution.

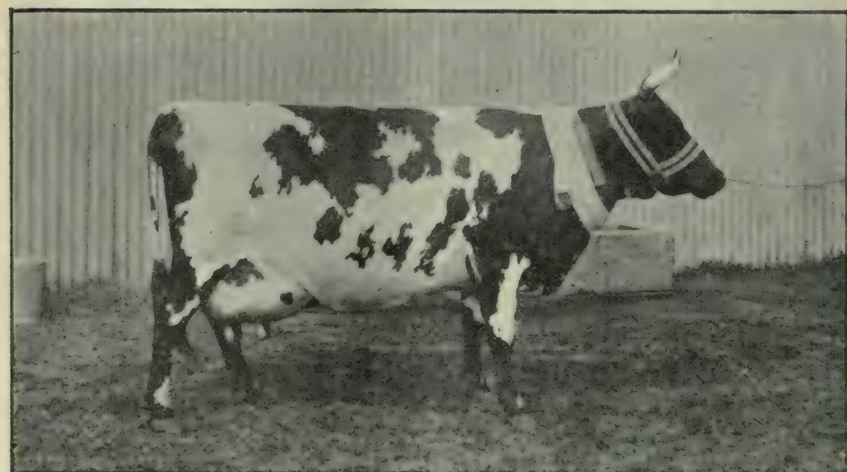


18. Reserve Champion Ayrshire bull, Waterfall of Greystanes, the property of Messrs. Morton and Frazer.

grass totalled 9,560 lb. of milk, or 421 lb. of butter. Heartsease is by Favourite (imp.), from Australian Pansy. Australian Pansy, who is out of Pansy IV (imp.), as a heifer on her first calf gave 5,821 lb. of milk, or 262 lb. of butter. This young animal is for sale.

Some leading Prize-winners at the Sydney Show.

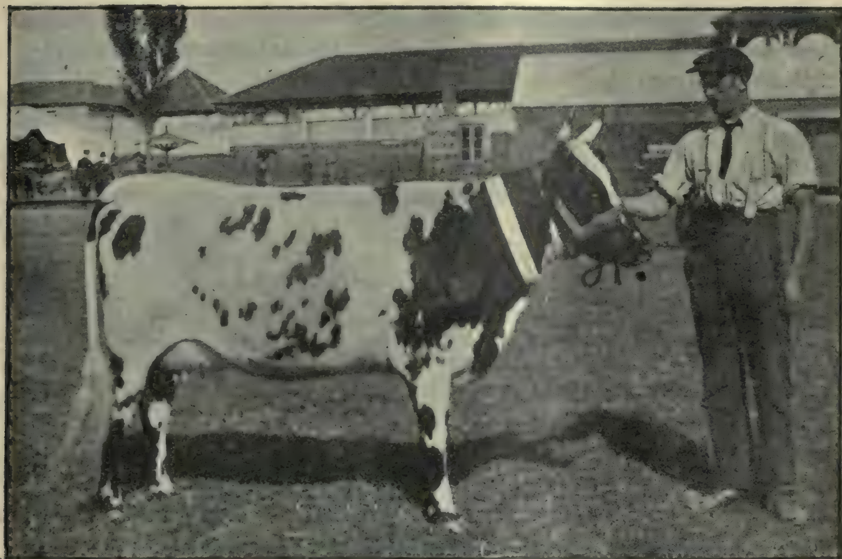
The Champion Jersey cow, Leda's Snowdrop, 6 years old, bred in the Island of Jersey, the property of Mr. G. W. Eaton, is by Lead's Golden Lad,



19. Champion Ayrshire cow, Whinflower. A cow of great constitution, with a grand bag and good teats.

from La Roque's Snowdrop. She is a very fine animal right through, with a beautiful udder and a good head, showing both quality and constitution, striking the happy medium which is so suitable in the show ring, because, while the characteristics of the breed are preserved, the milking qualities have also been developed to a high extent.

The Champion Guernsey bull, Golden Standard (imp.), 4 years old, is by Golden Jewel, from July Rose I. He is an imported beast, the property of the Camden Park Estate, Limited, and bred in the Island of Guernsey. He is a beautiful example of masculinity combined with symmetry. Many would fault him for being on the large size, and some considered him a little inclined



20. Reserve Champion Ayrshire cow. A cow of good head, horns, and type.

to be coarse, but this is erring on the right side, because we do not wish our Guernseys to become mere show ring animals, but rather to convey their best characteristics to the Guernsey milking herds which are bound to be founded in this State. He is a bull of great character and constitution, and should stamp his characteristics on any of his progeny. Although the competitors were few in this class the competition was very keen, and the animals exhibited were all worthy of special mention.

The second prize bull in the aged class, namely, Messrs. Kinross Brothers' Prince of Peace, by Rose. Prince (imp.), from Gentle (imp.), is an animal of great dairy qualities, and though not clean in the nose is a beautiful bred beast. He is very good about the middle piece, but lacks a little in masculinity. No doubt he will improve considerably in another year.

A very promising animal shown was Merton Signet II (imp.), who captured the first prize for bulls under 3 years of age. He is by Merton Signet, from Merton Lady, and is owned by Mr. Sylvester Browne. This bull is of a very rich colour and of beautiful quality. He should in time be the makings of a champion. He is the son of one of the best Guernsey bulls that has been shown in England for some time.

The Champion Guernsey Cow was Merton Margaret II (imp.), the property of Mr. Sylvester Browne. She is by Merton Signet (imp.) from Merton Margaret, and is an animal of true Guernsey lines, and a good stamp of a dairy cow.

She was closely followed for the championship by Messrs. Kinross Brothers' young Guernsey heifer, Golden Laura, by Laura's Boy, from Gold, a youngster of great dairy type and considerable substance, who, with another year's age, will be difficult to beat as a Guernsey female. This latter heifer was bred by Mr. Dixon Cooke on the Richmond River, and is a credit to his herd.

Conservation of Fodder.

During a recent visit to the Camden district an interesting case of the advantage of conserving fodder was noted.

Last April the occupier of Spring Hill farm, owned by Mr. A. L. Bennett of "The Oaks," made 30 tons of bush or native grass hay from the luxuriant growth of a paddock of 25 acres. A herd of thirty milch cows has been fed on this hay for the past few months with most satisfactory results. The farmer considers that the hay was mowed at a cost of 3s., raked for 1s., and carted to shed for 6s. per acre, making a total cost of about 10s. per ton. The hay was stacked the day after cutting. The long grass remaining on the portion of the paddock that was not mowed merely dried off and blew away; on the mowed portion the second growth was greatly relished by the cows, and the turf appeared to be thicker than on the uncut portion.

The paddock consisted chiefly of Blue Grass (*Andropogon affinis*) with a little Wallaby Grass (*Danthonia*), and Three-awned Spear Grass. The farmer, who is a comparatively new arrival from England, stated that the neighbours informed him that the native grass hay was worthless. On the contrary, the cows are extremely fond of it, and are milking well on the feed.—W. R. Fry.

Government Stud Bulls available for service at State Farms, or for lease.

Breed	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Dora's Boy ...	Cornish Boy ...	Lady Dora	Wollongbar ...	*
,, ..	Royalty ..	Royal Duke II..	Plush ..	Tuckurimba (near Coraki).	7 Sept., '09.
,, ..	Pansy Duke ...	Earl March ...	Pansy 4th ...	Wollongbar Farm.	*
,, ...	March Pansy ...	Earl March ...	Australian Pansy	Grafton Farm ...	*
,, ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd.	Berry Farm ...	*
Jersey ..	Thessalian II ...	Thessalian ...	Egyptian Princess	Steve King's Plains (near Coraki).	8 June, '09.
,, ..	Golden Lord ...	Golden King ..	Colleen	Wagga Exp. Farm	*
,, ...	Sir Jack ...	Omelette's Pride	Lady Tidy 3rd (imp.).	Berry Farm ...	*
,, ...	Berry Melbourne	Melbourne ...	Rum Omelette	Berry Farm ...	*
Guernsey ..	Gentle Prince ..	Rose Prince ..	Gentle ...	Coraki	Sept., '09.
,, ..	The Admiral	Hawkes Bay ..	Vivid... ..	Wollongbar Farm.	*
,, ...	Prince Milford..	Rose Prince ..	Flaxy ...	H. A. College, Richmond	*
,, ..	Vivid's Prince...	Rose Prince ..	Vivid ..	Upper Orara ...	Jan., '10.
,, ..	Prince Edward..	Rose Prince ...	Vivid ...	Woodburn	21 Oct., '09.
,, ...	Star Prince ...	Calm Prince ...	Vivid ...	Alstonville District	17 Dec., '09.
,, ...	Prince Souvia ...	Vivid's Prince...	Souvenir ...	Wollongbar Farm.	*
,,	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Paterson District	Oct., '09.
Red Poll ...	The Judge ..	Barrister ..	Lovely 8th ...	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General... ...	Judy 9th ...	Bathurst Farm ...	*
,, ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ..	*
,, ...	Auchenbrain Spicy Jock (imp.).	Howie's Spicy Robin.	Another Mayflower	Berry Farm ...	*
,, ...	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
,, ..	Jamie's Ayr ...	Jamie of Oakbank.	Miss Prim ..	Wollongbar Farm.	*
,, ..	Emerald's Mischief.	Prince Emerald	Miss Prim ...	H. A. College, Richmond	*
,, ...	Dado	Daniel	Dot	H. A. College, Richmond	*
Kerry	Bratha's Boy ...	Aicme Chin ..	Bratha 4th	Glen Innes Farm..	†
,, ...	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Dexter Kerry	Waterville Punch.	....	.. ..	Grafton Farm ..	*
Holstein ...	The Hague ...	President ...	Lolkje Veeman	H. A. College, Richmond	*
,,	Obbe II ..	Obbe	La Shrapnel .	Wollongbar Farm	*
,, ...	Hollander ...	Bosch III ..	Margaretha ...	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

Our Dairy Business in Great Britain.

As others see it.

Mr. J. F. Pearson, of Messrs. Pearson and Rutter (Ltd.), one of the largest produce distributing houses in Manchester and Liverpool, has been visiting this State to investigate the conditions of the produce trade, more especially in butter and cheese, and has called at the Department of Agriculture and expressed his views as follow:—

Mr. Pearson is a strong advocate of Government grading of produce exported to the Old Country, and produces clear evidence that this State is suffering in prices by comparison with New Zealand and other Australian States, through the absence of some standard of grading which could be accepted by the big distributing agencies in Great Britain. He says that firms like his own cannot offer New South Wales butter with the same satisfaction and assurance with which they can deal with butter from Victoria and Queensland, more especially the latter State, where the standard is consistent and satisfactory. New Zealand butter, on an average, brings ½d. per lb. more than New South Wales, simply because of the excellent all round quality and the confidence in the Government grading which has been engendered throughout the trade in Great Britain. Mr. Pearson insists that the best New South Wales butter is equal to the best from any other part of the British Empire, but there is, unfortunately, a great deal of second and third class butter sent to England, which reduces the average reputation of this State's butter.

He strongly urges that our factories should imitate New Zealand factories in having daily deliveries of milk and doing the separating themselves, or, in any case, having a daily collection of cream throughout the summer months, in order to ensure the quality of the article supplied.

He lays great stress on the use in packing of good material, especially preservative, salt, and parchment paper. He finds that some of the salt used has as much as 2·4 per cent. of impurities, generally earthy matter, which has a most deleterious effect on the butter, whereas the best Cheshire salt is shown to have as little as ·01 per cent. of impurities. Any factory manager can at once gauge the purity of his salt by examining it with a small glass magnifying twenty times, when he will see that the pure salt consists of clear crystals, perfect cubes in shape, several of them being sometimes joined together, but each a perfect crystalline cube, whereas in the salt of inferior quality there are lumps irregular in shape though often crystalline in appearance. It is this foreign matter in these irregular crystals which does so much harm to the butter. A common impurity in some of the salt is sulphate of lime (gypsum), which Mr. Pearson asserts can give an inferior flavour to butter originally first class in quality.

Mr. Pearson strongly insists upon the necessity of using nothing but pure water of the best quality, and notes that in the United States it is universally considered that water used in the washing of butter should not contain more than ·6 per cent. of foreign matter. It was some time before the butter-makers of the States realised their foolishness in at the same time using salt which contained four times as much impurities, but the fact has been driven home to them, and many of them are now importing the best Cheshire salt although the protective duty in the States makes that article twice as expensive as the home-made salt.

Again, he finds that inferior parchment is used, although the saving may be as little as ¼d. on a box of butter, and this occasionally causes spots or mould on the butter, and at all times affects the appearance and selling value of it.

Mr. Pearson speaks highly of certain grades of butter that come from the North Coast, and admits that one brand is so widely and favourably known, that it needs no Government grading, and has at the same time nothing to fear from such a policy, because it would always rank as A1; but "so long as factories making inferior butter can hoodwink their shareholders into believing that their output is first-class quality, when the buying experts know that it is inferior and pay accordingly, so long will it suit some people to avoid the crucial test."

It is satisfactory to know that Mr. Pearson has a high opinion of the qualifications of Australian graders and testers, and generally finds that their judgment is justified after the six weeks' voyage to the Old Land. There are several little points on which Mr. Pearson lays stress with regard to the matter of grading. "Every man so employed should be a practical butter-maker, and not merely a theorist, who may have learned his business in college, or even in the butter trade. He should have an intimate acquaintance with the making of butter, so that he can trace the mischief, whenever he detects it, to its true source, and indicate the remedy. The right man can infallibly discover and point out the cause of the trouble, which in 99 cases out of 100 is simply dirt, uncleanly methods, or the mixing of inferior cream with the bulk, when such should be thrown away or churned separately."

Mr. Pearson notes with satisfaction the strenuous efforts being made by the authorities in this State to educate the dairy farmers and the younger generation of agricultural students in the principles underlying the making of butter and cheese, so that they are now able to understand and know the reason for every step taken in the process of manufacture and the cause of every failure.

Mr. Pearson strongly urges that "all grading should be done privately without a grader seeing the name of the factory or supplier, and that the grade, whatever it may be, should be stamped on each box, and not merely indicated on the consignment notes or bills of lading. This is a very important point to the distributor, as the retail buyer looks for the grade-mark on the box. By far the greater part of the butter sold is bought confidentially by the retailer, and not inspected at time of purchase. Hence the importance of a reliable standard and grade stamp."

He urges the use of the small amount of preservative (0·5 per cent.) allowed by the British Pure Foods Act, and deems that 0·25 per cent. is enough, if the preservative is of first-class quality, and one of the Boron derivatives. He has inspected some of the factories when working in the preservative with the salt, and has found that with efficient working, the 0·5 per cent. is ample, about half of it being worked out of the butter, leaving sufficient to keep the latter in excellent condition on the journey. He finds that the slight deterioration on the voyage, which is inevitable in any perishable commodity like butter, is generally found to be fairly uniform, so that in the great majority of cases the butter graded as best at this end is still best at the other end, although not so good to the tester's palate in London as the best Danish, or the best New South Wales butter when tested in the Sydney market.

He lays great stress on the fact that all the defects which now characterise large quantities of our product are remediable, and that fishiness and other serious defects can be obviated by simple means, generally through cleanliness, both at the dairy farm and at the factory, and daily collection of cream by the factories. In a state where the hand separator is universally used, this daily collection is of the first importance, and its beneficial effect would at once be apparent.

With regard to cheese, he urges caution in making any sudden effort to develop the cheese business, as the trade in that commodity is strictly limited, and cannot be expanded in the same way as the butter trade. He urges cheesemakers to give one month's curing before shipment, and affirms that any good cheese made here in October, and delivered in England from end of January to end of March would meet with a satisfactory market, coming within ¼d. a lb. of the best cheese from Canada, or elsewhere of similar quality. He would remind cheesemakers that the best size for the British market is a cheese of 70 to 90 lb., preferably about midway between those weights. Smaller cheese are unpopular both with the trade and with the consumer.

With regard to the marketing of butter, Mr. Pearson is of the opinion that the producer who persistently consigns to the same market during a period of say ten years, is just as likely to receive as good an average return as the producer who consistently sells on the Sydney or other local market to the representatives of the many English buyers who are willing to buy regularly at the full value of the produce, having regard to the probable course of home markets. He does not consider there is much to choose between the two methods, if consistently carried out; but thinks that such a free and open local market is an inestimable advantage to producers.

Rearing Calves.

Mr. E. Turnbull, of Albury, does not quite agree with the method of rearing calves advocated by Mr. H. R. Alexander in the January number of the *Agricultural Gazette.*

In that article Mr. Alexander stated:—

> Three feeding systems are in vogue among dairy farmers—from troughs, by means of rubber teats, and by bailing up and feeding from buckets. Having tried all these methods I can unhesitatingly recommend the last mentioned. . . . . . Feeding by means of teats may have some good points, but experience has proved to the writer that results never compensated for the trouble and expense connected with the rubbers and tubes.

Our correspondent states that the trouble referred to by Mr. Alexander can be entirely overcome as regards the suction tube, and the expense enormously reduced in respect of the rubber tube, if the proper kind of feeder be used. He advocates the use of a calf-feeder consisting of a stiff iron suction tube, one end of which leads into the milk. To the other end is fastened a brass socket into which is screwed a removable valve which controls the feed of milk, irrespective of the worn condition of the mouthpiece. Over this is fitted a rubber mouthpiece with a flange to enable the feeder to be retained in a hole in the fence.

Mr. Turnbull contends that a saving is made by reason of his suction-tube being made of iron as against soft tubing and other feeders, and the rubber teats can be used with just the same good results even if the whole of the end of the teat be worn away.

The valve with which it is fitted effects a saving, it is stated, of 8 gallons of milk per day on every twenty-five calves fed.

Mr. Turnbull goes on to say:—

"It is safe to suppose that Mr. Alexander knows the reason why a calf reared on the cow is infinitely better than one reared by hand, yet he condemns the system of feeding the calf on a feeder which produces the same action as the cow, in favour of allowing the calf to drink from a vessel, thereby gulping down his food without the saliva going down gradually with it, so causing so many of the troubles, great and small, so prevalent in calves at the present day.

"As for the trouble, I cannot understand how Mr. Alexander comes to reject such a valuable little appliance as the calf-feeder, as in all the six years I have been rearing calves I have not had the slightest trouble as regards them taking to the feeders, and surely it is easier to have a few pens, and draft a batch of calves out to the feeders, and then you can go away and be doing other work near by at the same time."

In reply, Mr. Alexander states :—

"I would not withdraw my statements *re* calf feeding-methods.

"I have used both soft and firm tubes. Soft tubes were a complete failure; the stiff pipes were a considerable improvement on the soft ones. Have never used the tubes written of by Mr. Turnbull.

"Theoretically, feeders should be ideal; it does not follow in practice.

"The calves at Wollongbar speak for the method recommended by me. I do not want them to look any better. Some of the neighbours are following this Farm's example *re* feeding bails, &c.

"I do not allow stud bulls to be reared on their dam, or even on a foster mother, as I consider I can make them better dairy animals in every way by bucket feeding."

Improvement of Orchard Soils.

Where the soil of the orchard is harsh and parched, its condition and moisture-retaining properties can be improved vastly by means of green manuring. Trials at the various Departmental orchards have demonstrated that in all but citrus orchards, crops of the pea family, sown in autumn and turned under just when they attain the blossoming stage in early spring, are productive of excellent results. Slap-dash methods cannot be adopted, however, in connection with the sowing of field peas or vetches in run-out soils. For one thing the seed is pretty expensive, and unless the ground is prepared carefully and a little stimulant in the way of a dusting with bone-meal or superphosphate is added, there will not be much grëen stuff to turn under. But if the ground is well prepared, and it is borne in mind that whatever slowly-soluble phosphatic manure is put in at sowing time will be merely converted for the requirements of the fruit-trees, satisfactory results may follow.

Several seasons ago comparative experiments were carried out at the different orchards, and the balance of opinion was in favour of vetches or tares, which not only produced the most luxuriant mass of easily turned-under green stuff, but possessed the deepest root-system with the peculiar function of nitrogen-gathering exerted to a great degree.

The quantity of seed per acre, where trees are planted 20 feet by 20 feet, is about 2 bushels, but the quantity of fertiliser added, must be regulated by the condition of the soil. Under fair conditions $\frac{3}{4}$ to 1 cwt. of superphosphate or bone-meal per acre should suffice, but in some cases it would, undoubtedly, pay to add twice that quantity of bone-dust in order to enliven the soil.

Artificial Incubation.

[Continued from page 306.]

G. BRADSHAW.

Moistnre and Ventilation.

HOWEVER perfect the eggs may be for hatching, and correct the temperature, the best results need not be expected if the moisture and ventilation are below or in excess of requirements, and it is these elements which have given manufacturers and operators more thought and worry than any other feature connected with artificial hatching Not that there is any difficulty in providing either of the elements in any given quantity, but rather that the degree of such which give good results in one hatch may, through atmospheric conditions, be entirely at fault in the succeeding one, and the hatching poor in consequence.

During the period of the first hatch, the weather may have been hot, with dry winds, and the moisture in the atmosphere almost nil, while in the currency of the second trial, moist conditions may have obtained, thus lessening the requirement of artificially supplied elements. Not that these atmospheric variations do not reach the eggs when under the hen, but rather that by percolating through the feathers the degree is modified, which, with a subtle influence imparted by the hen, counteracts the effects of such variation for ill; and this is one reason why artificial methods can never quite compete with the hen.

In relation to moisture, sensitive appliances have been invented for measuring it. This, however, is not the question, but rather to know the quantity required for respective hatches in different altitudes, extreme atmospheric and other conditions which obtain in the many countries and thousands of places where hatching is carried on.

One large manufacturer and operator wrote on this subject as follows:—

From the earliest history of artificial incubation until the present day the one great bugbear has been moisture. In the very oldest types of incubators, where the fumes of the lamp entered directly into the egg-chamber, until the present day, when all such is eradicated, the question that confronts the operator is moisture. For many years the manufacturers of the hot-water machine seemed to solve the problem; then the hot-air machine came before the public and they still advocated the use of moisture. We have now come to the time when many manufacturers advocate that no moisture at all is required. This is only a delusion. The problem that confronted the operator ten years ago still confronts him to-day. It is reasonable to admit that many a chick was sent to an untimely grave by the free use of moisture, and many more will be sent to the same grave by the lack of moisture. There are plenty of conditions in which an incubator can be operated where no moisture is required, but, on the other hand, there are just as many places where applied moisture must be used. There is absolutely no question about this. That machine is not built, and cannot be built, that can be used in every climate, and every altitude, and require absolutely no moisture in these changes of location. Many prospective customers are led to believe that applied moisture is all wrong. This is well and good if their certain locality has sufficient moisture in the air and the incubator has provisions for supplying a sufficient amount of moisture to the egg-chamber, but if such arrangements and conditions have not been studied carefully, then to herald the idea

that no moisture is required simply makes one more dissatisfied operator and one more incubator to be placed in an outbuilding never to be used again. Taking up the history of the incubator, it was found that in many places no moisture at all was needed, while in other sections of the country of a drier temperature, and where the incubator cellar was warm and dry, applied moisture had to be supplied. No incubator has stood the test and been more successful than this machine, yet it has been found by actual operation in nearly every section of the world that moisture had to be supplied in some cases, and in other places it was not needed at all; hence the idea of no moisture is not a new one, for it all depends upon the operator. The question of moisture which confronted the operator ten years ago, confronts him to-day. It is not a question of new idea, but it is a question of studying his surroundings, his climate, and a sufficient amount of pure, fresh air introduced into the egg-chamber.

Many other quotations could be given to show that earlier experimentalists believed that correct gauging of the moisture would solve the problem of dead in shell. Later and more exhaustive work has proved that moisture and ventilation are associated with and dependent on each other for good or bad results. A celebrated biologist lately contributed the following to an English paper on the subject, entitled "The first Essential to Artificial Incubation":—

To get at the requirements, to find the laws, that should cover and rule any process, we must first be sure what we are trying to accomplish; that part of it is clear enough. In this case we want chicks, ducklings, etc., and we want to know the most essential requisite to produce them artificially. The egg must be as fertile as healthy parent stock are able to produce it, and it must have been kept in a manner not to injure the chances it received and had when laid.

This is the thing which we take from nature, and from now on we try to do artificially what the hen would do herself if let alone. We take the word of people who measured the body heat of the hen, and try to run the incubators as near that temperature as possible, say from 101° to 104°. The simple fact that a specified degree is not necessary to have the best results is proof enough that there must be other more important requirements.

Moisture, the old stumbling-block of all the incubators as we found them on the market a few years ago, is now happily a thing very nearly solved. I say very nearly, for not in all cases, and not in all climates, will the no-moisture racket prove advisable.

No-moisture machines will only be found filling the bill everywhere, if they have the first essential requisite of incubation. There are always two conditions found in the dead chicks: one, where they show up too plump, as a result, it is claimed, of too much moisture; the other, where they are all right in size, but nevertheless fail to hatch. I contend that the ventilation is the cause of both these conditions. Some may lay it to moisture, but all will admit that moisture is dependent upon ventilation.

Ventilation is conducive of air-currents, and as a larger and stronger air-current will require more fuel to be added, the ventilation problem solves at the same time the heat question. No heat, how steady, or how high, or how low, will produce a bird, if the ventilation is lacking to supply the growing germ with the oxygen required. The germ has a heart action, commencing at the age of 36 hours; that is known, and the chances are it needs the invigorating air from the first hour. Now then, how can we expect results if we fail to give that which is pre-eminently necessary to sustain life.

Moisture is only needed when the eggs have been unnaturally dried down or out during the first period of the hatch; it is used in that case to check the further evaporation.

The way to apply this first essential, ventilation, is as follows: let the fresh air, heated to the degree required in order not to lower the inside temperature, travel at a snail's pace through the machine, and arrange it that no egg breathes the air expelled by any other. Top ventilation is good, provided it is not warm weather. In hot weather, look out or your eggs may suffocate.

One of the recent inventions in incubators has the ventilation so arranged that all the air, before getting in the chamber, must travel through cloth of some kind, in that manner reducing the direct current. This is needed in most of the machines.

Reduce the current, or if the machine is not arranged so that this can be done, shut up the ventilating holes entirely, and air while you turn the eggs. Beware of the currents, and watch that the first essential requisite of artificial incubation, a proper ventilation, is carried out in the machines, and the moisture question, as well as the other incubator conundrums, are all solved smoothly and intelligently, and poor hatches are the exception and not the rule.

The above authorities, from their experiments, advance opposite conclusions. One considers moisture the chief element to good results, the other puts ventilation first; but in either case readers are left to draw their own conclusions as to the quantity and a means of measuring or gauging it.

It has often been contended that when testing the eggs during the incubating period the size of the air-cell at the thick end of the egg will be a safe guide as to whether moisture has been supplied in excess or otherwise. But there have been numbers of experiments made where eggs in the same incubator have shown varied degrees in the size of this air-space. A thin-shelled egg would evaporate much quicker than would the thick-shelled one.

Perhaps the most intelligent article on this subject in recent years is that by E. C. Huffaker, which was lately contributed to an American paper, *Farm Poultry*, and is worthy of reproduction:—

The history of the embryo comprises two stages. The first, which embraces the first eleven days of incubation, may be termed the creative; the second, the growing stage.

During the first stage the outlines of the future chick are laid; the courses of veins, arteries, and nerves are traced out; bones, muscles and tendons are fashioned and put in place; the heart, the brain, the liver, the lungs, and the kidneys are perfected in form, and to each is assigned its own peculiar function; the heart is set beating, the blood to pulsating, and the period closes with the chick virtually complete in every part.

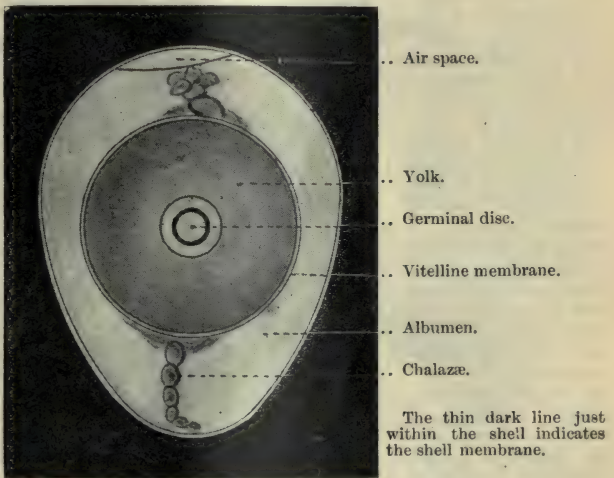


Fig. 1.—Egg of Fowl in longitudinal section (after Marshall).

The second stage is ushered in by a marked activity of all the organs of the body. The chick, which hitherto has remained small, now begins to grow; the temperature rises; the completed organs perform their various functions in the animal economy; the blood vessels of the allantois, rapidly encircling the egg, gather nutriment from the egg, oxygen from the outer air, and expel carbonic acid and other poisonous gases from the system. All the processes of growth, decay, and repair, the wasting of tissues, and the replacing of dead particles by living ones are inaugurated. Henceforth the history of the chick is chiefly a history of its growth.

In this marvellous development of the chick, nature endeavours to run on schedule time; at the end of each day a certain definite point is to be reached; at a certain hour the heart is to begin beating; on a certain day the work on the windpipe must begin, and at a certain specified time it must be completed. Certain connections are to be made. A nerve and a bone are made, and a hole is to be bored through the bone just in time for the advancing nerve to pass through. The full development of the chick must be timed to meet the closing of the allantois blood vessels, else the chick may perish in trying to get out.

This perfect timing can be carried out only when the proper amount of heat and pure air suitably moistened are applied to the egg; and perhaps the cause of nearly every

failure of fertile eggs to hatch may be traced to improper heating, improper ventilation, or an improper supply of moisture. The effect of too high a temperature is to unduly hasten development, of one too low, to retard it. But the evil effects of variations in the temperature are not so marked as those following an improper supply of fresh air or moisture.

Fresh air is necessary to development during the first or creative period. Just what purpose it serves we do not know; but we do know that if the supply be limited, the germs will either not develop, or, possibly, will die before the end of the period. Thus I have tried the effect of a very light coating of oil on eggs, and found that only about 10 per cent. of the germs developed, and that those which developed were weak. Again, I have found that in very warm weather an unusually large percentage perished before the twelfth day, whereas in cooler weather, or with better ventilation, very few have died. I have also found that in running incubators A and B, A has uniformly developed more germs than B, owing—as I think—to a better system of ventilation.

After the growing stage sets in, the evil effects of impure air are similar to those produced among all warm-blooded animals, after birth, with the exception that they are oftener fatal. The function of oxygen in the animal economy is in part to burn out the worn-out particles of matter contained in the blood, and in part to supply animal heat by the combustion of carbon. Particles of matter in the living body are continually perishing, and as continually being replaced by others endowed with the principle of life, and the dead matter removed is in all respects similar in chemical constitution to that of the whole body after death. Soon after death decomposition sets in, which, in the absence of oxygen, engenders poisons of such deadly nature that the particles adhering to a surgeon's knife are sufficient to produce death. Poisons similar to these result from the decomposition of the dead particles within the living body, and these find their way into the circulation whenever the supply of oxygen is insufficient, whereas if these dead particles are introduced into blood sufficiently charged with oxygen, they are quickly decomposed, and rendered harmless until they can be expelled from the system, through the agency of the excretory organs.

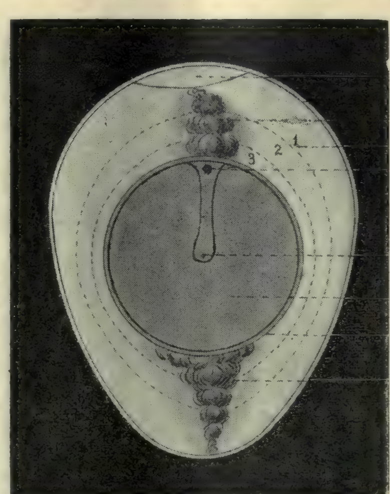


Fig. 2.—A Fresh Fertile Egg
(after Marshall).

The products formed by this decomposition are water, urea, and carbonic acid, and in order that the blood may be kept pure, the supply of oxygen must not only be ample, but must be constant. If the supply is scant the more deadly poisons referred to above are formed.

In order that these excretory organs in mature animals may perform their functions properly, they must be kept in a healthful condition. The skin must be kept clean; the pores open; the lungs must be sound; the kidneys active, and none of the organs must be overtaxed. It is a well-known fact that if any one of those organs fails to perform its functions, the others are called upon to do double work, and if the extra work be too long continued, the organs become enfeebled and incapable of doing even their normal amount of work. The derangement of one organ quickly involves others, and thus the failure of any organ to perform its functions may result in the derangement of the whole system.

The immediate effect of breathing impure air is to allow the blood to become filled with poisons. This leads to abnormal activity on the part of the skin and kidneys; and, if very long continued, to enfeeblement and a diseased condition of these organs. Then

follows a general derangement of all the organs of the body,--of the heart, liver, stomach; and, as a result of digestive disturbances, imperfect nutrition, emaciation, cessation of growth, and premature decline may follow.

Such we know to be the evil effects which ensue from long continued breathing of impure air—as in the case of children reared in large cities, or kept in crowded school rooms. Every text-book on physiology is replete with stories of the evil effects of breathing impure air, and a comparison of the children reared in cities—pale, listless, delicate—with those growing up in the open houses of the mountains—rosy, vigorous, overflowing with life and good humour, justifies all that has ever been said in behalf of pure air.

When we consider that the second stage in the development of the chick is one of growth, and that one of the most marked effects of impure air is imperfect nutrition and consequent retarded development; and when we consider further that the time for growth is limited to a few days, we can understand why so many chicks die in the shell. I have myself broken the eggs of hundreds of such chicks, and have found them in all stages of development. *Failure to grow* is the cause to be assigned in nearly every case. Very rarely have I found chicks with organs incomplete. A definite amount of nourishment is stored in the egg for the chick during the growing stage, and until it has consumed this it cannot get out. Hence it must grow to get out, and failing to grow, it perishes.

Fig. 3.—New Laid Egg with part of shell removed.

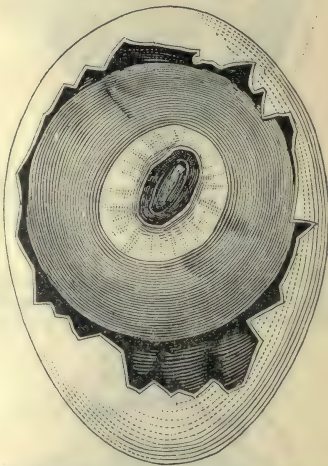


Fig. 4.—An egg as it appears 36 hours after incubation, with a magnified view of the embryo chick.

One of the surprising things of life is the far-reaching effect of obscure causes.

The same cause, or causes, which lead to chicks dying in the shell will lead to the death of many of those which hatch. Hence the law in artificial incubation, that the more chicks hatched the more we can count on raising; while the poorer the hatch the poorer will be our success in raising those which hatch. In other words, the same cause which leads to the death of some before hatching will lead to the death of others after hatching, and the enfeeblement of those which survive. What is the cause? Malnutrition; and this may be set down as the cause (barring accidents) of death of nearly all that die after hatching. The chicks die because they fail to grow. The same causes that enfeebled their digestive powers before hatching continue their deadly work when the chicks are out.

If the supply of oxygen is very scant, the effect on the immature organs of the poisons generated is to render them constitutionally defective, and hence we find that when we get our chicks out, leaving a large per cent. dead in the shell, they are bright enough and pretty enough for two or three days; but, no sooner than they begin to eat than a general derangement follows, and their delicate constitutions go to pieces without apparent cause. I have taken a hatch of forty chickens, fine lively fellows, out of an incubator, and had every chick die within a week.

In what has preceded I have attempted to show the importance of ventilation. It is proper in the next place, in view of its commanding importance, to inquire how much ventilation is needed, and what it is going to cost us. It is possible that, like man, the embryo chick cannot have too much fresh air, and that, like man, with an unlimited amount of fresh air it will only use what is needed.

But as man shuts himself up in dwellings with a limited supply of fresh air, in order that he may economize in the matter of fuel to keep him warm; so in artificial incubation we find it necessary in view of the cost of ventilation, to reduce the amount to the minimum necessary for the wants of the chicks. It may, however, in general, be said that the amount regularly supplied must be such as to suffice at all times, whatever the outside temperature, and that we should err on the safe side by having a superabundance. We have no means of measuring the oxygen delivered to the eggs, as we have in the thermometer for measuring the temperature, and we can only learn by experience how much is needed in any given locality.

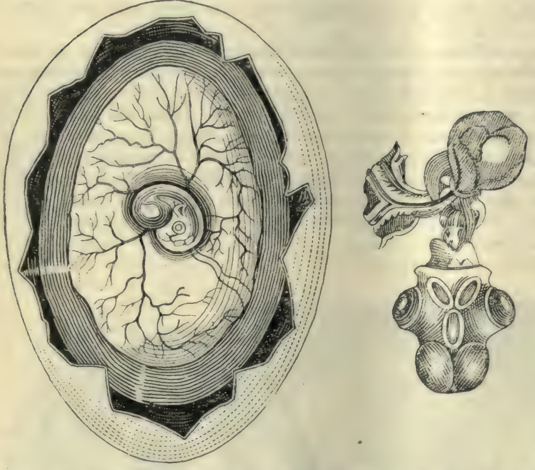


Fig. 5.—An egg opened four days after incubation, with a magnified view of the chick.

Perhaps the most economical method of ventilating the eggs is to admit fresh cold air directly into the egg chamber from the outside, the heat being applied by radiation only. Where the eggs are heated by a current of warm air passing over them the heat required to warm the air is all lost when this air escapes from the egg chamber, except the amount extracted by the eggs and the walls of the incubator. In order to keep the eggs at a temperature of 103° it is necessary that the air should have a slightly higher temperature, and on leaving the incubator the temperature will be but little less than 103°. Let us suppose that it escapes into the outer air with a temperature of 100°, that the outside temperature is 60°, and that the amount of air passing through the egg chamber every six hours is 10 cubic feet. The heat lost will then be that required to raise 10 cubic feet of air 40° every six hours, or 1 cubic foot 400°.

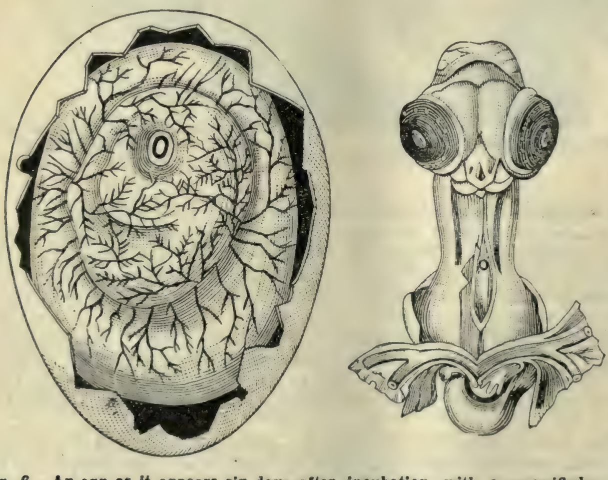


Fig. 6.—An egg as it appears six days after incubation, with a magnified view of the chick.

On the other hand, if the eggs are heated by radiation from an overhead drum, and air having a temperature of 60° be introduced into the egg chamber from below, and if means of escape be provided at some point above the level of the eggs, then it is only necessary to raise the temperature of the air admitted to that necessary to produce the required circulation. Let us suppose that an increase of 10° in temperature will caus

Fig. 7.—An egg as it appears ten days after incubation. The embryo chicken, from the preceding egg, with the vesicle removed.

10 cubic feet of air to pass through the egg chamber every six hours as before, then the heat lost would be that necessary to raise 10 cubic feet of air 10°, or 1 cubic foot 100° every six hours. The heat lost in ventilating the eggs is thus seen to be but one-fourth as great as in the former case. If we take into account the heat lost by radiation into the outer air, this estimate will, perhaps, not be far wrong. In practice I have found

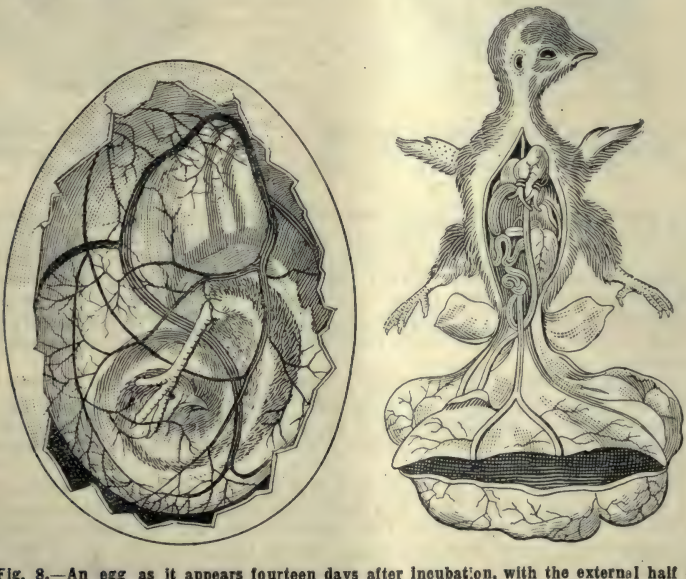


Fig. 8.—An egg as it appears fourteen days after incubation, with the external half of the vesicle removed, and the embryo chick, showing the course of the blood vessels.

that it takes at least three times as much oil to run one incubator as it does to run another, although holding more eggs.

But it may be asked: Is it not absurd to talk about hatching eggs in an atmosphere having a temperature of only 70°? Not at all; and we might just as well have placed it at 30°, as far as the principle involved is concerned.

To illustrate: One may make himself altogether comfortable by a good fire with ice forming in the room near by. See how quickly one chills if some one gets "between him and fire." The radiant heat is thereby shut off, and he instantly realises how cold the air is by which he is surrounded. Radiant heat has very little effect in elevating the temperature of the air through which it passes, while on the contrary it is largely absorbed by any solid substance like the shell of an egg. Moreover the conducting power of the shell is high, so that the radiant energy absorbed by its upper surface is quickly transmitted to the lower surface, and to the interior of the egg. The eggs may thus be maintained at any desired temperature—say of 103°, while the mass of air passing through them is many degrees lower. It is true that the air would, after a time, be warmed by contact with the eggs and with the walls of the incubator, but this will not take place if the circulation is sufficiently rapid. Herein lies the beauty of this system of ventilation; each individual egg produces its own ventilating current. The air in immediate contact with the egg becomes heated to a temperature approaching that of

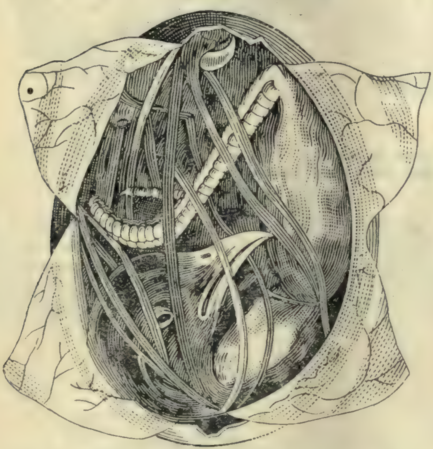


Fig. 9.—An egg as it appears eighteen days after incubation, with the vesicle removed to show the embryo chicken.

Fig. 10.—An egg as it appears twenty days after incubation, showing the position of the chick in the egg.

the egg itself, and, therefore, much warmer than the surrounding air; as soon as it becomes heated it rises, giving place to the fresh cool air surrounding it. No sooner, therefore, does the air perform its function of supplying the egg with oxygen and taking up its load of exhaled gases than it rises and leaves it, whereas if the air be heated by a current of warm air above 103°, no such movement takes place, and we have to rely on the movement of the whole mass of air to sweep the eggs clear of poisonous gases. For this reason a smaller amount of air is required when air is admitted unwarmed into the egg chamber.

Still another advantage to be gained by admitting cold air from below is that any carbonic acid which may collect in the bottom of the egg chamber, as this gas tends to do in the bottoms of wells, mines, &c., at once flows out by its greater weight; so that altogether the air in the egg chamber is at all times kept as pure and wholesome as it seems possible to make it.

So effective is this system of ventilation that the operators find it necessary to add pans of water regularly about the tenth day, to prevent excessive evaporation.

In addition, by admitting cold air from below we are able to keep the lower surface of the eggs sensibly cooler than the upper, which, being nature's way, is the one which may be most safely followed. This cannot be satisfactorily accomplished with a current of warm air.

It will be seen from the above, and in practice is well known, that while moisture and ventilation are inseparable, the effects of both are dependent on another factor—evaporation ; and all three combined have been the subject of much investigation by a number of the American experiment stations.

The United States Department at Washington has lately collected all the established data from these places, duly edited and epitomised them as follows :—

Evaporation of Eggs and other factors which affect Incubation.

During incubation the egg loses water by evaporation, and the amount lost has an effect upon the number of eggs which hatch. C. A. Whiting, who recently studied this question of evaporation, found that during incubation a fertile egg lost a little over 20 per cent. in weight, while a sterile egg receiving like treatment lost 15·5 per cent. Another fertile egg, weighing 2·22 oz., lost during incubation 21·64 per cent in weight. The chick hatched from the egg weighed 1·55 oz., or 29·65 per cent. less than the egg before incubation. A fertile egg shaken vigorously to destroy the germ lost 17 per cent. during incubation.

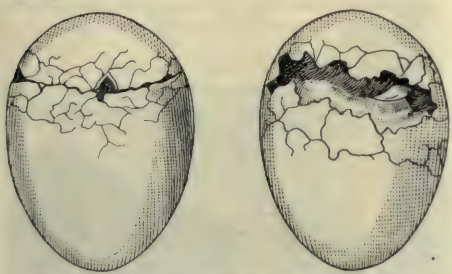


Fig. 11.—Eggs chipped by the enclosed chicken.

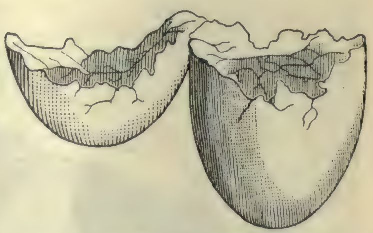


Fig. 12.—Position of shell after escape of chicken.

In tests carried on at the Ontario Agricultural College and Experimental Farm to secure data regarding the evaporation of eggs under different conditions with reference to the number which hatched, it was found that when eggs were hatched by hens in nests in the open, the average evaporation of those which hatched was 10 9 per cent. The same figures were obtained with eggs hatched in a nest lined with rubber cloth and placed inside a building, and a slightly higher value, 11·9 per cent., with nests containing a layer of moist earth and kept inside a building. The highest evaporation of eggs which hatched, 15·15 per cent., was observed with nests containing chaff and kept inside a building. In the case of incubators the average percentage of evaporation of eggs that hatched ranged, under different conditions, from 9·1 to 16·3 per cent. Considering both natural and artificial incubation, the range was from 5·9 to 27 per cent. With outdoor nests 87 per cent. of the fertile eggs hatched ; with indoor nests containing moist earth, 85 per cent. ; with indoor nests made of chaff, 77 per cent., and with an indoor nest lined with rubber cloth 100 per cent. In the incubator tests 65 to 76 per cent. of the fertile eggs hatched. From the recorded data, W. R. Graham, who conducted the investigations, believes that the best results will be obtained when the evaporation is controlled so that it is about that of eggs hatched by hens with nests out of doors on the ground.

Tests made at the University of St. Louis, by A. C. Eycleshymer, showed that during natural incubation the loss by evaporation was 13 per cent. of the original weight of the egg and that this loss could be lessened to 9 per cent. and still the egg would give a healthy chick. When increased, experimentally, to 20 per cent., perfect chicks were also obtained. These results are in general much the same as those obtained at the Ontario Experimental Farm, and if average values are considered, it seems fair to conclude as did Eycleshymer that in artificial incubation "the moisture in the incubator should be so controlled that it will allow the evaporation of about 13 per cent. of the original egg."

In the experiments at St. Louis University the effect of a number of other conditions on the incubation of eggs was also studied.

As regards the turning of eggs, Eycleshymer points out that—

> The hen turns the egg in two ways. If a sitting hen be watched as she returns from feeding to sitting, it will be seen that she moves her body rapidly from side to side. Whether the object be to turn the eggs is uncertain. Probably, the first object is to bring the surface of the body in the closest possible contact with the growing embryos. Accidentally or purposely she also turns the eggs. This is not only true of the hen returning from feeding, but also when on the nest, for she is frequently observed moving about and settling down with the same characteristic lateral movements. Sometimes there are so many eggs in the nest or they are so widely scattered that the hen fails to properly cover them. When such conditions occur, the hen invariably uses her beak to bring the outlying eggs in contact with her body. Not only does she frequently thus turn the eggs, but also she very often reaches beneath her body and turns the eggs lying near the centre of the nest. Why she does this is a question which awaits an answer.

H. F. Prince, who studied this question at the Agricultural College of Cornell University with a number of hens, found that in every instance the eggs were moved every day and did not remain in the same part of the nest for more than three days. "The thorough manner in which the hen turns the eggs may well furnish us a clue to the most natural and proper treatment of the eggs when under the artificial conditions of the incubator."

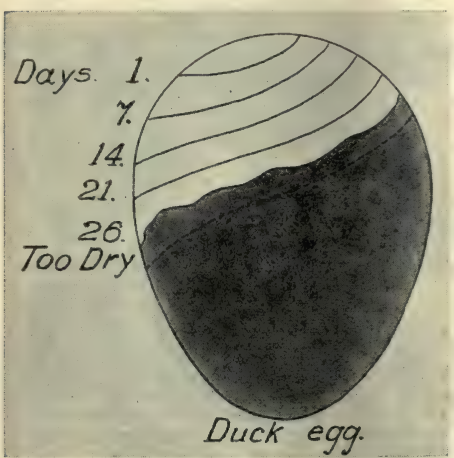


Fig. 13.

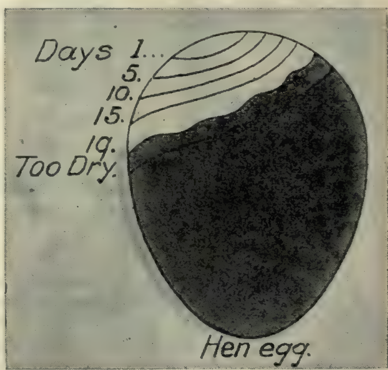


Fig. 14.

Eycleshymer's experiments with an incubator showed that the best results were obtained when eggs were turned frequently, at least five times. The embryos in unturned eggs not infrequently die, the principal cause of death being attributed to the allantois, a membranous sac essential to the normal development of the embryo, growing fast to the yolk, which causes the rupture of the membrane enclosing the yolk, and allows it to escape, so that it cannot be taken into the body of the embryo. When the eggs are turned it is probable that the position of the allantois is shifted and thus adhesion to the yolk is prevented. "It should be remarked that during the early days of incubation it is also necessary to turn the eggs frequently, otherwise the embryo grows fast to the shell membrane."

In a study of the effect of temperature, a great many observations were made of the temperature of the eggs directly under the hen, of the hen's body, and of the eggs during incubation. Special thermometers were used, and precautions taken to secure accuracy. Under natural conditions, in the author's opinion, his observations show that the proper temperature of eggs during the first week is about 100 degrees F., 101 for the second week, and 102–103 for the final week. In the case of artificial incubation, the experimental data reported led to the conclusion that the most favourable temperature within the egg-chamber is close to 102–103 degrees the first half of the incubating period, and 103–104 for the latter half.

In any consideration of temperature, the fact must be kept in mind that as the chick grows it gives off more and more heat, so that if an incubator of 200-egg capacity were entirely without artificial heating the temperature would be much higher than that of the surrounding atmosphere. It consequently follows that less artificial heat is necessary during the later stages of incubation. The 102–103 degrees in the earlier stages is largely artificial heat, while the 103–104 in the later stages would be the combined animal heat given off by the egg and the artificial heat supplied by the heat radiator.

Under natural conditions eggs are cooled somewhat at intervals during incubation when the hen leaves the nest. It may be stated with a fair degree of certainty that the cooling of the eggs is due to the necessity of obtaining food, and in no way fundamentally affects the growth of the chick when there is an abundant supply of fresh air.

There is not the least doubt, however, but what it has a beneficial influence in cases of poor ventilation, and since no incubator is supplied with too much, it probably is best to adopt the common practice of cooling the eggs. In so doing it would not seem advisable to cool the eggs for more than twenty to thirty minutes each day for the first fifteen or eighteen days.

In natural incubation under usual conditions eggs are well ventilated, as fresh air can always reach them by diffusing through the feathers which cover them, and foul air pass off in the same way.

As might be supposed, it has been found that the degree of ventilation has a decided effect upon the percentage of eggs which hatch in incubators. In the tests made at the University of St. Louis, 85·7 per cent. of the fertile eggs hatched in an incubator provided with special ventilation, while only 44·3 per cent. hatched in an incubator without ventilation.

When a perfect ventilation has been obtained it has produced certain deleterious effects which must be corrected. It is commonplace to say that when evaporation goes on in still air, this air soon becomes saturated, and evaporation, if not stopped, goes on very slowly. If, however, the saturated air is constantly removed, and dry air takes its place, the rate of evaporation is increased.

It is thus evident that any discussion of ventilation must take into consideration the question of moisture.

Illustrations reproduced from the "Zoological Journal."

(*To be continued.*)

Malting Barley.

"Maltster," in a letter to the *Daily Telegraph*, says :—

There is at the present moment an unsatisfied demand for malting barley, and strenuous efforts ought to be immediately put forth by the Department of Agriculture to induce farmers to sow the crop. Brewers are more than satisfied with malt made from New South Wales barley, for so good is it that none other would be used, and 4s. 6d. per bushel is a price now offered for tens of thousands of bushels. The yield per acre is about twice that of wheat, and the proper seed can be easily obtained. There are two requisites—the crop must be clean, and the stripper must not to be used to harvest it.

It may be added that barley to the value of £107,000, and malt to the value of £67,000 were imported into the Commonwealth during 1908, the barley coming from the United States and New Zealand, and the malt from Great Britain and Germany. It is not too late this season for a trial of this crop.

Varieties that have done well in the respective districts are indicated in this month's notes for the respective districts.

Barley requires a fairly rich soil that is naturally well-drained and friable. Great care should be paid to the seed-bed and sowing so as to ensure even ripening, which is essential for malting purposes.

About ½ bushel of seed per acre (drilled) has given satisfactory results.

Appeal on behalf of the Farrer Fund.

It will be remembered what splendid work the late William Farrer did on behalf of the wheat industry by his painstaking and laborious investigations into the nature and qualities of the different wheats then growing in the State, in the cross-breeding of certain varieties and producing new types, at least half-a-dozen of which have been proved to be of very great value, it being generally admitted that "Federation" is now the champion wheat of Australia for most of our dry districts, and for the prevailing conditions of New South Wales wheat-growing.

The Committee who have the matter in hand are anxious to get sufficient money to found a Scholarship for a farmer's son, to carry him on in his agricultural education, more especially with regard to the cross-breeding of wheats.

The definite purpose of the fund cannot be stated until the amount shall be known. If a comparatively large amount —say £1,000—could be raised, the interest on that would provide a Scholarship to take on one of the bursars from the Hawkesbury Agricultural College to the University classes, and might be the means of providing a valuable expert for the State. If, however, the sum reaches only £200 or £300, the yearly interest will be just sufficient to provide a good prize, which will not be so potent a factor in influencing our educational system, though it will serve its purpose in perpetuating the name and memory of William Farrer.

The Committee have tried the plan of sending out a large number of circulars, but without the amount of success expected. They have lately also tried a canvasser; but it is found that the ratio of expense to the amount collected is far too great, and the Committee cannot see their way to allow any considerable portion of the amount collected to go in commission or

travelling expenses, or for any other purpose than the one in view. They have determined, therefore, to make a personal appeal to all interested in the wheat industry, and to ask them to send their mites to Mr. T. I. Campbell, Secretary of the Farmers and Settlers' Association, 3, Spring-street, Sydney, or to the undersigned. The amount in hand at the present time is about £160, in addition to which promises of cash and wheat amount to another £100.

I now make this personal appeal to every wheat-grower in New South Wales, to every branch and to every member of the Farmers and Settlers' Association, to every miller, and to every landed proprietor who is interested in the development of the wheat industry, to give some assistance to the fund, to make it worthy of the object in view, and to enable the Committee to close it at an early date, so that the money may be invested and the interest applied to an educational object bearing the name of William Farrer.

HENRY C. L. ANDERSON,
Under Secretary.

Agricultural Bursaries.

In connection with the approved scheme of agricultural education, arrangements are now being made for the granting of annual bursaries to the Hawkesbury Agricultural College, the Wagga Experiment Farm, or the Bathurst Experiment Farm. When accommodation shall have been provided at Wollongbar Farm one bursary will be granted to the School Farm there.

The Regulations governing the granting of these bursaries are as follows :—

1. Three bursaries each will be given to the Hawkesbury Agricultural College, Wagga and Bathurst Experiment Farms.

2. Each bursary will provide free board, lodging, and education, but all incidental expenses for books, medical and dispensing fees, chemicals, sports, &c., must be met by the bursar.

3. Bursaries will be awarded after competitive examination. Such examination will not be so much academic as designed to test fitness for agricultural education, special attention being given to aptitude and requirements for future career.

4. Applications for bursaries must be on the forms provided for the purpose. Parents or guardians must produce satisfactory proof to the Minister that they are unable to pay the usual fees, and that the applicant could not get the required education without the aid of a bursary.

5. Candidates for bursaries must be over the age of fifteen years, and not older than nineteen years.

6. Other things being equal, preference will be given to the sons of men engaged in rural occupations, and as far as practicable the bursaries will be evenly distributed over the State, each being made available at the school best suited to the student's past experience and future requirements.

7. It must be distinctly understood that the accommodation and fare provided at the Farm Schools will be simple, and adapted to the student's future career as a worker. The main purpose of the education will be to turn out practical farmers.

8. Any bursar who is idle, inattentive, or unsatisfactory in conduct or progress, will be liable to immediate dismissal by the principal or manager. Bursars must conform to, and obey the rules and regulations for the time being in force for the government and management of the college or farm to which he may be sent.

9. Bursaries will be renewed only upon passing any prescribed term examinations, and on gaining a satisfactory report on the year's work and conduct from the principal or manager.

The first bursaries will be available for the 1910 session.

Seasonable Notes.

It is the desire of the Minister of Agriculture (the Hon. John Perry) that the attention of agriculturists throughout the State should be directed to the importance of timely and proper preparation of areas for cropping. Every practical farmer will admit that under our climatic conditions the opportunities for favourable sowing are generally few and far between; and unless we are able to make the most of every propitious slant of weather, the returns suffer.

The Minister recognises fully that it is impracticable to lay down directions applicable to the prevailing conditions of every district; even within the space of half-a-dozen neighbouring farms there may be wide differences in respect of soil, rainfall, lateness or earliness of season, and all sorts of things that affect the sowing and growth of crops. Still, the Minister feels that if readers of the *Gazette* will regard these seasonable notes in their true light, viz., the outcome of prolonged practical experience in a certain portion of each climatic region referred to—and will weigh them carefully in relation to their own local conditions and experience, good results will be achieved by adoption of the suggestions thrown out.

Mr. Perry will be very glad if successful agriculturists throughout the State will co-operate with the Department of Agriculture in this endeavour to point the way month by month, and sufficiently far in advance of the season, to permit of timely and effective preparations for cropping. By this means it is hoped the foundation of substantial improvements in methods and monetary returns will be laid.

With the co-operation of progressive agriculturists in every district, and with the results, as they become available, of all the systematically planned practical demonstrations which he has caused to be undertaken on a large number of private holdings as well as at the Departmental farms where the cost of production will be taken into accurate account, the Minister is confident that the Department will be able to offer advice that can be thoroughly relied upon and turned to profitable account.

This month it will be noted that an effort is made to place before wheat-growers a few of the important factors governing the successful production of wheat, and having regard to prospects as they appear at the time of writing, special attention is devoted to the methods calculated to be most effective should weather conditions prove to be unfavourable. For those who care to go more deeply into the subject a special *Wheat Bulletin* was prepared in January last so as to give more timely directions. Copies of the *Bulletin* may be obtained, free of cost, on application to the Under Secretary, Department of Agriculture, Sydney.

Farmers are reminded that the purpose of the Department of Agriculture is to advance their interests in every way practicable, and that all inquiries concerning the production of crops, rearing of stock, or treatment of diseases, will be promptly answered.

Notes and short articles embodying personal practical experience will be highly appreciated and acknowledged, and when of general interest, reproduced for general information.

The Minister further desires to remind settlers, and beginners especially, that in connection with the supervision of demonstration areas on various farms, the Chief Inspector (Mr. Geo. Valder) and his staff of practical men are continually travelling through the farming districts. It may often happen that some knotty problem is encountered which it is difficult to set forth clearly in a letter of inquiry, but which might be threshed out and settled readily on the spot, if timely application were made to the Under Secretary for one of the experts to pay a call in passing.

Cultural Methods for Wheat-growing in Dry Districts.

GEO. L. SUTTON, Wheat Experimentalist.

In districts of scanty rainfall, methods which have for their object the conservation of soil moisture are of paramount importance, and, compared with these, the consideration of other questions, such as what are the most suitable varieties, or what quantity or kind of fertiliser to use, are of comparative insignificance.

In dry districts the rainfall is so light, or so irregular, that, if crops are to be grown, all that is possible must be conserved, for it is too valuable to be wasted. Under natural conditions much of the water that falls is wasted; to prevent this waste is the problem of the dry country farmer, and in proportion as he is successful in doing this so will he be successful in his operations.

In these districts rain very rarely falls just when required, so that success depends upon the amount of water that can be retained in the soil, rather than upon the amount of water that falls. The dry country farmer must regard the soil chiefly as a water reservoir, and must adopt methods which enlarge and increase its capacity for water, and which will enable the soil to retain what has been stored with as little loss and waste as possible. That moisture can be stored in the soil is now a recognised fact that admits of no argument.

The usual cultural methods as practised by farmers at the present time are inadequate to make the most of the rain that falls. With such methods,

practically only the rain that falls during the growing period is of value to the wheat crop, with the result, that when the rainfall during this period is insufficient for a crop, failure occurs, though the rainfall previous to the planting season may have been good.

It is the lack of methods which provide for the storage of the water that falls some time previous to planting, that makes wheat-growing, at the present time, such an uncertain occupation in some of the drier districts. If the most is to be made of the rain that falls during the growing season, and success very often hinges upon this, the ground must be in good condition as far as soil-moisture is concerned at planting time. This necessary condition can only be brought about by commencing to prepare the soil for crops some time previous to the planting period. In other words some system of fallowing in which the initial operation takes place some time previous to the planting season is necessary.

In dry districts a proper system of fallowing is, therefore, an essential of success, and the general adoption of a proper system in our wheat districts is a factor which will do more than any other to remove wheat-growing from the area of speculation, and place it on a sound and solid basis. With a proper system in practice, the rainfall of the previous, or a portion of the previous year, can be stored, conserved, and utilised for a subsequent crop.

Fallowing as practised by many farmers consists in ploughing the land in winter or early spring, and then allowing it to remain undisturbed until just before planting time, when it is re-ploughed or cultivated before it is seeded. This plan is good in that it loosens and aerates the surface soil, facilitating the absorption of rain, and thus enlarging the natural capacity of the soil as a water reservoir, but it is deficient in that it does not provide for preventing waste and loss by evaporation of the water stored. As the conditions in our wheat districts are favourable for evaporation the loss from this source is very great, in fact in many cases as great as if ground had been cropped, in which case the stored water would have been put to some profitable use. This system is, therefore, incomplete in that it does not provide for reducing the loss (caused by evaporation), by working or cultivating the fallowed land.

In order to comprehend why working the fallows reduces the loss of moisture by evaporation, it is necessary to understand something of the natural law of capillary attraction. Under natural conditions the rain that has been absorbed by the soil and subsoil is afterwards brought to the surface by the natural force of capillary attraction, and unless protected from the action of the sun and wind will be lost by evaporation. On small areas this is effectively done by covering or mulching the surface with straw, or, as market gardeners do, with stable manure. These materials are effective in retarding evaporation because they are loose and of such a character that water does not freely rise through them to the surface where the sun and wind can cause evaporation. On a wheat farm in dry districts it is not a practical possibility to cover the surface of the large areas necessary for profitable cultivation with such material. Fortunately loose dry soil acts in a similar

way, and in such soil the force of capillary attraction is very largely inactive, and so, if the surface of the soil is kept loose and dry by cultivation, it acts as a protective covering for the moisture-laden soil beneath.

This loose covering of surface soil is called an earth or soil mulch. While not preventing all the loss that would take place by evaporation, the soil mulch is very effective in saving soil moisture. Soils rich in organic matter form better mulches than loamy mulches, whilst loamy and sandy soils form better mulches than clay soils. Professor King, of Wisconsin, found by experiment that in 100 days a 3-inch mulch on a marshy soil saved 56 per cent. of the moisture, and the same mulch on virgin clay soil saved 63 per cent. of the moisture that would otherwise have been wasted by evaporation had the soil not been mulched. By keeping the surface of fallowed land worked and loose the soil, in addition to being in the best condition for conserving moisture, is also in the best condition for absorbing it. It has been found that loose soil will absorb 40 per cent. of its weight of moisture, whilst compacted soil will only absorb 20 per cent. If waste is to be prevented, it is necessary that the soil be loose, for quantities of water sometimes fall in a short time, and it is necessary that the soil be in a condition to absorb it freely and quickly.

The fact that water can be stored must not be taken to mean that water can be produced. The right methods of cultivation will enable the farmer to make the most of the scanty rainfall, but they will not produce moisture. The very best methods can never take the place of irrigation in districts where the rainfall is too light to produce crops. A certain amount of water is required to grow any crop; the following table, compiled from data collected in Germany, is taken from the "Physics of Agriculture" (King), and shows the minimum amount of water necessary to produce given crops of wheat.

TABLE showing the least amount of water required to produce different yields of wheat per acre when the ratio of grain to straw is 1 to 15.

Yield per Acre.				
Number of bushels.	Weight of grain.	Weight of straw.	Total weight.	Water used.
15	·45	·675	1·125	4·498
20	·60	·90	1·500	5·998
25	·75	1·125	1·875	7·497
30	·90	1·350	2·250	8·997
35	1·05	1 575	2·265	10 495
40	1·20	1·800	3·000	12·000

This table shows that about 6 inches of effective rain during the growing period, should admit of 15 bushels of grain, or 1½ tons of hay, being produced, provided the ground was in good condition, so far as the soil moisture was concerned, when the seed was planted. Though data from which this table was compiled was obtained in Germany, actual results at Coolabah last year indicate that the table is approximately correct, even for our dry climate.

Starting with the soil moisture in good condition from the rains that had fallen previously to planting, 85 tons of hay were harvested from 55 acres, and the best yield of grain, computed from the small field plots devoted to grain trials, were at the rate of 19 bushels of grain per acre, whilst the average of the check variety was about 12 bushels per acre.

Though methods which include a system of fallowing and working the fallows will provide that the rain falling previous to planting time will be absorbed and conserved ; and though, incidentally, they cause dormant plant food to be released, and put the soil in the best physical and mechanical condition for the production of crops, yet, with all these advantages, they are not complete, but are deficient in the respect that they make no provision for restoring the vegetable matter of which the soil is depleted, as the result of it being cultivated. The effect of cultivation is to burn up the organic or vegetable matter in the soil. It has been estimated by a French observer that in the three summer months as much as one third of vegetable matter in the soil has been destroyed by tillage.

Humus, or decaying vegetable matter, surpasses every other ingredient of the soil in absorbing water vapour, and in improving the water-holding capacity of soils, and just as fallowing and working the fallow, stores and conserves the moisture, so the incorporation of humus increases the holding capacity of the soil for water.

As fallowing tends to deplete soil of vegetable matter, methods which provide for a system of fallowing without making provision for restoring the vegetable matter to the soil are similar to those of a man who regularly cleans out his tanks to ensure that their capacity is not diminished, but who, at the same time, lessens the water-holding character of the soil in which they are excavated. The following table show the value of humus for holding moisture :—

CAPACITY of field soils for moisture.

Depth.	Sandy Loam.	Clay Loam.	Humus soil.
	Per cent.	Per cent.	Per cent.
First foot........... ...	17·65	22·67	44·72
Second foot......... ...	14·59	19·78	31·24
Third foot	10·67	18·16	21·29
Expressed in inches..	3·00	3·50	5·00

Seeing from this table that a humus soil is capable of holding the equivalent of 2 inches more rain than a sandy soil, and 1½ inches more than a clay loam, the great value of humus for increasing the water-holding capacity of our soils is very evident.

Not only do soils containing large quantities of organic matter contain more water, but they give off their water by evaporation more slowly than those from which the humus has been burnt out. This is an advantage the value of which can hardly be exaggerated.

The effect of humus on the fertility of the soil is well shown by the illustration (Fig. 1, page 7, *Agricultural Gazette*, 1905), where the influence of a small quantity of stable manure and decayed vegetable matter spread immediately around the trees on a soil composed of almost pure sand at the Hawkesbury Agricultural College orchard, is very evident by the greatly increased growth of the green crop adjacent to the tree, and which is altogether out of proportion to the amount of plant-food supplied in the stable manure and vegetable matter, which, in some cases, consisted chiefly of dried and shredded cornstalks.

The beneficial effect of commercial fertilisers is largely influenced by the amount of vegetable matter in the soil, and they are most active when there

Fig. 1.—Showing effect of Commercial Fertiliser alone in sandy soil.

is a supply of humus. An illustration of this was afforded by the results attending the application of some organic manure (abattoirs refuse) to a portion of the orchard at the Hawkesbury Agricultural College, which had previously received an application of complete fertiliser. On the portion receiving the organic manure in addition to the commercial fertiliser (Fig. 2) the growth of the green manure was very much greater than that receiving only the commercial fertiliser (Fig. 1). The produce from a square yard from each portion was weighed, and it was found that from the portion receiving the organic matter in addition to the fertiliser, the weight was $6\frac{1}{2}$ lb., whilst that receiving only the fertiliser, was $2\frac{1}{2}$ lb. (Fig. 3). This is a most

striking difference, and one which shows in an unmistakable manner that only on soils supplied with organic matter will commercial fertilisers prove most effectual.

The value of organic matter for maintaining the fertility of the land, especially in dry districts, can hardly be over-estimated. In addition to increasing the water-holding capacity of the soil, which in dry districts is the principal factor governing fertility, it permits chemical action, and by its slow decay produces carbonic acid gas which liberates plant-food. By its lightness it improves the texture of many soils, and this is especially the case with our clay soils. This will explain why our virgin soils are more easily worked than those which have been under cultivation for several years. Originally they are well supplied with humus or decaying vegetable

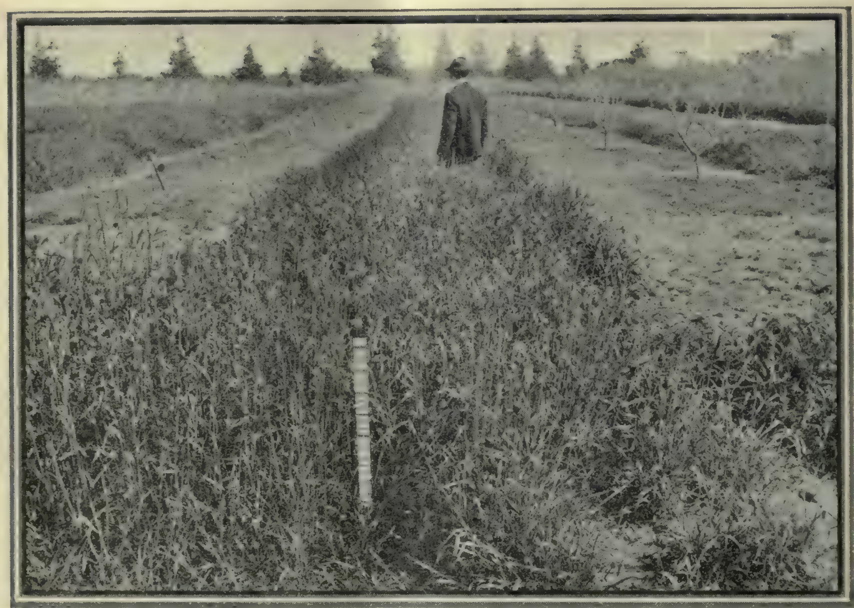


Fig. 2.—Showing effect of a little organic manure in addition to commercial fertiliser.

matter, but as they are cultivated the vegetable matter in them becomes depleted, unless provision is made to restore it, and in consequence they run together and set hard after rain, becoming increasingly difficult to work as the years go on. Unless provision be made to restore the vegetable matter, the soil will eventually become so depleted of humus as to become practically barren, and will fail to respond to the application of commercial fertilisers. If the fertility of the soil is to be maintained, the vegetable matter burnt out by cultivation must be replaced, and seeing that vegetable matter is of such great value, the practice of destroying such a large amount of it by burning off the stubble of stripped crops is not to be commended. The proper plan is to incorporate this directly, or preferably indirectly, in the form of

sheep droppings, after it has been fed off. This is impossible where the practice of growing wheat continuously year after year is followed, for between the crops there is not time to feed it off, and if ploughed in the soil will be so loose that it will not be in a proper condition to obtain the best

Fig. 3.—(a) Result of commercial fertiliser alone.
(b) Result of commercial fertiliser and organic manure.

results with the wheat crop. Under these circumstances, and for the sake of the succeeding wheat crop, it is necessary to burn the stubble off (Fig. 4), and for this reason alone if for no other, the practice of continuous wheat growing on the same area is unsuitable for a dry climate.

Methods that are to be entirely satisfactory for dry districts must include a system of fallowing and in addition must make provision for regularly

Fig. 4.—Burning off the stubble.

restoring the vegetable matter burnt out of the soil. This can be done in two ways, either by periodically allowing the cultivated land to revert to pasture, or by grazing fodder crops which on being fed off renovate the soil, and will add organic matter to it, but more rapidly than if the renovation takes place as the result of turning the land out of cultivation.

Riverina.

G. M. McKEOWN, Manager, Wagga Experiment Farm.

Wheat.—This is the best month for sowing wheat in the neighbourhood of Wagga, therefore the work should be pushed forward as rapidly as weather conditions will admit.

Preparation.

Experience in a variety of seasons has furnished ample proof that it will pay wheat-growers to thoroughly prepare the land for sowing, and it is recommended that all soils of fair depth should be ploughed to a depth of 6 inches where practicable. This cannot be accomplished under all conditions experienced here, as much of the Riverina soil sets very hard in dry weather, and is then difficult to work.

The method of preparing land by merely scarifying the surface of stubble paddocks is strongly condemned, as it can only have a chance of success in unusually favourable seasons, which, unfortunately, are of rare occurrence.

Rolling and Harrowing.

In soil which is liable to crust on the surface, it is desirable, where rolling is necessary, to carry out the work before the seed is sown, and not to roll afterwards till the crop is fairly well grown, and then to follow with light harrows drawn across the drill furrows. Soils vary so greatly that it is not desirable to lay down any hard-and-fast rule on work of this kind, as much can be learnt by observation on the part of cultivators, many of whom have a variety of soils under their care in which uniform treatment would be undesirable. Under our conditions we have usually found it best to leave the land with the slight furrows formed by the drills, as an even surface is very liable to crust and cause the rainfall to run off.

Method of Sowing.

Some years ago tests of varying grades of seed, graded and sown by hand, were carried out on a small scale on this Farm, and the results were always in favour of the best qualities.

Trials of varying qualities of seed carried out on a fairly large scale with machine-graded seed resulted in a gain for first-grade seed of $2\frac{1}{2}$ bushels per acre above that harvested from second and third grades sown together.

The advantage of drilling over broadcasting seed has been frequently advocated and demonstrated. The increased yield, together with the saving in cost of seed, will more than cover the cost of a drill on the first 150 acres. Trials of varying quantities of seed have been made, and results amply demonstrate the desirability of sowing only moderate quantities of seed, as although sowings of 60 lb. per acre show a larger total return, the average gain from the extra seed is only nominal.

For general field work we set our drills to sow half a bushel; and as grain varies in size according to variety, our average sowing will work out at about 33 lb. to the acre. Half a bushel per acre under our conditions we regard as the minimum quantity to be sown, with a maximum of 40 lb. per acre for seasonable sowing.

Should sowing be delayed, as is sometimes unavoidable, the seeding should be increased to 50 lb. per acre to compensate for the decreased stooling or tillering power of the plants, which diminishes as the season advances.

Drill-drivers, when sowing, should see that their machines have the inner wheel so far overlapping the land sown in the previous round that the space between the rounds shall not exceed that between the tines of the drill.

It is frequently noticed in district crops that the space of a tine is left unsown in every round through failure to drive with the necessary overlap. As these blanks are equal to 8 per cent. of the area prepared for sowing, it will be realised that the omission is an expensive one.

Fertilisers.

Tests carried out during the past eight years have shown that very profitable results may be obtained from the use of moderate quantities of superphosphate drilled in with the seed.

In districts with a light to fair rainfall a maximum sowing of 60 lb. per acre is recommended. If this quantity be exceeded, there is a risk of crops suffering should adverse conditions set in, as a larger bulk of manure may remain partly undissolved round the roots of the plants. In new land the quantity may be reduced to 40 lb. for the first sowing. In course of time it will probably be found necessary to increase the quantity, and to supply a fertiliser more closely approaching a complete manure.

With the use of fertilisers it has been shown that the yields of grain may be increased by 35 to 40 per cent. at a very moderate cost. It is necessary, however, that the manure should be sown with the drill, so that the young plants may receive benefit from it from the beginning. The root system is rendered more vigorous, and the plants are induced to feed at a greater depth, thus utilising a greater area of soil for their sustenance than is the case where the manure is sown on the surface or the crop is not fertilised. The supply of moisture, also, is better at the greater depth.

Top-dressing is unsatisfactory, as the roots are attracted to the surface, and the crop suffers when their growth approaches maturity, or when adverse conditions set in.

At Wagga, manured crops usually ripen about a fortnight earlier than those untreated, and most probably this feature will be found to have a very important bearing on the rust problem.

Sowing Time.

The best time for sowing is from the middle of April to the end of May; but, when circumstances require it, a week in June may not be too late. A good deal of sowing is carried out in Riverina before April; but in our portion of the district crops sown so early, no matter what the variety of wheat, have a tendency to produce too much straw in good seasons.

Should insufficient rain fall in March or April, there is considerable risk of loss of seed, or at the least of a severe check to earlier sown crops which may have obtained a start.

These risks, however, are greatly decreased by fallowing the land from winter or spring in the preceding year, as land so prepared is in a better condition to receive and retain such moisture as may fall between the ploughing and sowing seasons. As it is seldom that late sown seed returns anything like the crops harvested from seasonably sown areas, it will pay better to fallow such land as cannot be sown by the first week in June.

It has been noted that a curtailment of the areas sown should place many growers in a position to carry out their harvesting more seasonably, thus benefiting themselves individually, in addition to increasing our district average, as crops are considerably decreased by insufficient preparation of the soil which is due to a desire to sow large areas.

If the labour expended on such areas were concentrated on half or two-thirds of the land, seasonable sowing and harvesting would be possible, and the profit on capital and expenditure would be much greater than is the case at present.

Wheat for Hay.

The raising of wheaten hay for home consumption in ordinary seasons, for fodder reserves against drought seasons, or for sale in the city markets, is worthy of greater attention than is usually given to it. Under our conditions a crop of wheaten hay may be counted on with much more certainty than is the case with oats, which requires much more moisture to bring it to perfection. It is, however, possible to secure payable crops of oaten hay when good varieties are sown early in the autumn.

The average hay yield at the Wagga Farm for eight years, including two drought years, is slightly over 2 tons per acre, which, in ordinary seasons, can be sold at a profit of £1 10s. per ton.

White straw wheats are far preferable to the purple straw varieties for hay-making, as the weight is much greater, the straw has far less "dead flag," and the hay is better liked by stock of all kinds. In selecting varieties, care should be taken to choose those which carry a green colour to the lowest possible point on the straw. The varieties which have proved the best with us are Zealand or Berthoud, White Essex, Australian Talavera, and White Lammas, in the order named. The best stage of growth for cutting wheat for hay, to secure weight, colour, and quality, is just when it is flowering. If properly saved at this stage and cut into chaff not less than half an inch, it will command the best prices in the Sydney market, as the best quality Riverina chaff is much sought after.

Treatment of Growing Crop.

The harrowing of growing crops may be carried out until the crops are about 6 inches high, provided the soil is firm enough to keep the harrows from penetrating deeply, but it should not be done before the plants are well rooted.

The best time for the operation is after the land has been made fairly firm by rain, as then there is less risk of damaging the crop by too deeply operating with the tines of the harrow. Damage to roots is thus decreased, and the chance of injuring plants by means of the bars of the harrow is also lessened.

Light harrows only should be used, and they should be drawn at right-angles to the drill furrows. Care should also be taken to avoid harrowing after any of the straw joints have formed in the plants.

Green Fodder.—Sow barley alone or with vetches or field peas. The skinless barley is one of the best kinds, it being very early, of excellent quality, and free from troublesome awns or beards.

Sow half bushel per acre of seed of each, if sown together, or three-quarter bushel of barley if sown alone.

Barley.—This is one of the best months for sowing, and the work should be carried out as early as possible.

For malting, the following varieties of the Chevalier type will prove the best, viz., Kinver, Golden Grain, and Goldthorpe. See February, March, and April numbers of *Gazette.*

Kitchen Garden.—Plant tree onions, potato onions, and eschalots. Sow onion seed in thoroughly pulverized land.

A hand seed-drill will be found an excellent implement for sowing these and other garden seeds.

To facilitate cultivation, onions should be sown in drills about 3 feet apart, the plants being as early as possible thinned out to about 8 inches apart in the drills.

Spanish, Globe, and Giant Rocca, and Extra Early Flat Red, will be found the best varieties for this district.

Make final sowings of cabbage and cauliflowers, and transplant available plants of both.

Among the best kinds will be found St. John's Day, Early Drumhead, and Early Spring, and of cauliflowers, Early London, and Asiatic.

Make final sowings of early varieties of white turnips, also broad beans and peas. Of the latter the best kinds are Yorkshire Hero and Improved Omega.

Field peas and vetches may still be sown, but sowing should be completed as early as possible.

The application of superphosphate in the drills with the seed at the rate of half cwt. per acre will greatly improve the crops.

Reminders for June.

So far as cropping is concerned, June is a fairly quiet month. Where it is intended to make a spring sowing of lucerne, much can be done at this season to prepare the clean and deep seed-bed which this crop demands. An area of naturally well-drained soil should be chosen, and after ploughing as deeply as circumstances will permit, the soil should be left to weather until the close of winter, when it can be worked down to a fine tilth.

Tuberous artichokes have proved to be an excellent fodder for pigs, and now is a good time to get a small area deeply worked for planting as soon as the danger of frosts is past. Sweet potatoes are also worthy of a trial for the same purpose.

BATHURST.

R. W. PEACOCK, Manager, Bathurst Experiment Farm.

Wheat.—It is wise to complete the sowings of wheats between 1st April and end of May. Generally speaking, early sowings yield the best crops; late sowings, very often, do not pay expenses.

Ploughing.—Soils vary to such an extent that it is difficult to prescribe any general method of treatment, and much must be left to the judgment of the farmer. The depth to plough varies considerably. Upon light shallow virgin soil 4 inches may be deep enough the first year. The following year it should be ploughed 1 inch deeper, and this continued until 6 inches is reached. The turning up of too much of the sour subsoil in one operation should always be avoided.

Selection of Seed.—The seed should be of the very best; it should be chosen from the heaviest yielding crop on the farm. The area from which the seed is to be taken should have the very best of treatment. Deterioration is rapid when slipshod methods are followed. Stud seed, or seed that has been carefully selected and not allowed to suffer deterioration for many years, should be used. All seed should be carefully graded to get rid of all second-class grains and weed seeds. It is more profitable to feed the chick-wheat to poultry than to sow it for crop.

Treatment of Seed for Bunt.—Treatment of the seed is necessary to combat stinking smut or bunt. Neglect in this particular may lead to a rejected sample at the mill. The treatment most desired is that which destroys the bunt spores without injuring the vitality of the grain.*

Quantity of Seed to sow per Acre.—No hard-and-fast rule can be laid down as to the most desirable quantity to sow per acre. Much depends upon the preparation of the seed-bed, time and method of seeding, variety, size, and quality of the grain, nature of soil and climate, and the freedom of the land from weeds. The seed-beds should be in a condition to allow the seed to be covered uniformly. The soil particles surrounding the grain should be sufficiently fine to ensure moisture being conveyed to the seed from the subsoil. Well prepared seed-beds require less seed than badly prepared ones. Sparse stooling varieties should be sown thicker than prolific stoolers. Early sowings may be thinner than later ones. Poor soils should be sown thicker than rich ones. A bushel of wheat of large grain gives fewer plants per acre than wheats of small grain. Clean land, or land free from weeds, may be sown much thinner than weedy soils; thick seeding may smother weeds if the wheat gets established first. If the climate is dry, wheat should be sown thinly and weeds kept in check by other methods. In moist climates heavier seeding may be practised. Twenty pounds of graded grain of good quality, properly treated for bunt, would be sufficient upon clean land in a climate of low rainfall if drilled in a decent seed-bed at a seasonable time. Thirty pounds would give a maximum result throughout the average wheat districts of fair average rainfall. Farmers must consider the above factors and weigh them in relation to the conditions under and beyond their control.

Methods of Sowing.—Drilling is unquestionably the best method of sowing; it allows of the seed being covered uniformly, the depth regulated, and manure distributed economically with the seed. Such cannot be claimed for broadcasting, either by hand or machine. It is more economical of seed, one-third less being required than by broadcasting. Upon soil that has been fallowed by ploughing thoroughly, the grain may be broadcasted and ploughed under to a depth of 3 inches to advantage. Such ensures uniform covering, and the seed is placed where soil moisture can ensure germination in comparatively dry weather.

Depth to Sow.—The most desirable depth is from 2 to 2½ inches. Under certain circumstances it may be sown deeper in friable soils. Deep-sowing

* *See* "Treatment for Smut," p. 436.

prevents many plantlets reaching the surface. It is not wise to plant deeper than 3 inches in ordinary soils. Two and a half to 3 inches allows of the placing of the grain into the moist soil away from the drying effects of sun and wind. Should heavy rains fall upon deeply-sown wheat before it appears at the surface, and a crust is formed, a large proportion cannot get through. Under such conditions it should be harrowed. Large wheat grains may be sown deeper than small ones.

Feeding-off Crops.—Early sown crops which have made considerable growth during the winter may be fed-off by sheep to advantage, if discreetly practised. Crops should not be fed too late in the winter, especially where dry weather during the early part of summer is the rule. Stock should not be turned on in wet weather, especially on soils with a fair proportion of clay in their composition. Continuous grazing for any length of time may be harmful. It is wise to subdivide a paddock if the whole cannot be completely eaten off within a fortnight. Crops which have grown very rank from any cause are much better fed-off, if at all practicable. Rank crops are liable to rust, to lodge, and to be injured by frosts, besides making large demands upon soil moisture. Reducing, by feeding-off, may ward off rust by allowing greater access of sun and air. The base of the stem is strengthened by access of light, and lodging prevented. Frosts, under certain conditions, may rupture the cells of the nodes or knots of the bottom part of the stems. The stems of the growth after feeding-off are not so liable to injury. Moisture is conserved by reducing the transpiring surfaces of the leaves which are in excess.

Rolling and Harrowing.—Rolling is advantageous to consolidate light open soils and fit rough land for the use of machinery; it should always be followed by the harrows. Harrowing loosens the surface, preventing the subsoil moisture rising to be dissipated by sun and winds. A compacted rolled surface has the opposite effect. Wheat after having been grazed should be thoroughly harrowed with sharp heavy harrows. It is preferable to harrow during early spring, before excessive evaporation from the surface of the soil commences; it may be performed when the crop is a foot high. It is better to harrow after a reasonable fall of rain, when the soil is fit to get on to with the teams.

Oats may be sown freely this month. In this district dry summers are the rule, and, generally speaking, the early and midsummer varieties are the best. Algerian is one of the earliest and best. Of the midseason varieties Carter's Royal Cluster, Surprise, Peerless White Bonanza, Abundance, and Potato are the most suitable. Abundance gives an excellent quality hay.

Barleys.—These should be sown early in the month. For malting, Standwell and Invincible are good varieties. For green fodder Cape is the most suitable. Smutted seed should not be sown, as it is difficult to combat this disease. Barley requires soil in good condition.

Ryes.—These may also be sown early in the month. Black Winter has proved one of the most consistent yielders for grain, and is also early.

It is most suitable for early green fodder and green manuring of bearing orchards. Its earliness allows of its being ploughed under during the winter. Rye is a valuable crop for poor soils in cold districts ; it withstands grazing well, and is worthy of more attention upon light soils. In the renovation of light soils it should be sown early, grazed all the winter, and allowed to run up during spring, to be eventually ploughed under to add organic matter to the soil.

Lucerne.—This may still be sown early in the month upon well-prepared rich soils.

Canary Grass.—This crop should be sown early in the month. It thrives in this district, and is a profitable crop. The demand for it is limited.

Vegetables.—Make early sowings of peas and broad beans. Make small sowings of lettuce and beet. Transplant savoy cabbage and broccoli. Plant tree onions, potato onions, eschalots, and garlic.

Reminders for June.

Oats may be sown this month. Algerian will be found to be a good all-round variety, but several others, like Carter's Royal Cluster, Peerless White Bonanza, and Abundance will be found worthy of trial. Land should now be made ready for the reception of seedling onions. A clean seed-bed is absolutely essential, and no effort should be spared to keep down the weeds. This is a good time, if opportunity occurs, to plough land that is intended for spring sowing. By doing the work now many weeds can be destroyed, and the roughly-broken soil will benefit much from exposure to frost. It is also a good time to distribute farmyard manure over land required for use in spring.

New England.

R. H. GENNYS, Manager, Glen Innes Experiment Farm.

Wheat will grow well on the New England tableland, and no better hay from suitable varieties can be produced if cut at the flowering stage and properly saved ; large yields of grain in favourable seasons can be produced, but there are few varieties suited to the changeable climate, and careful selection must be made before good average yields can be obtained. It is found, after careful observation and experimenting for four years, that the best sorts are strong-flour wheats that mature quickly. The time of sowing is important : if too early they may come in head before frosts are over, the flowering stage being a dangerous time in this connection. They should be harvested before Christmas, or they may be caught in the field by the summer

rains which take place after that period. Good milling wheats of early maturing varieties sown rather late—say in June—are likely to prove most profitable. Manitobas also have a good chance if sown fully two weeks earlier; very early sowing is not recommended.

Sussex, a wheat of fair strength, has given very good yields for several years, proving very suitable for the district. Power's Fife (a Manitoba of splendid flour strength) and the Blue Stems have also done very well, but should be sown earlier than the others on account of slow maturing.

Jonathan, a strong-flour wheat, has done remarkably well here, and produces excellent flour.

Zealand, Tardent's Blue, Power's Fife, and the Blue Stems (Minnesota, Haynes', and Bolton's) are recommended for hay wheats.

For wheat the summer and autumn ploughings are generally from 5 to 6 inches deep, afterwards before the seed is sown a shallow ploughing of about 3 inches is practised. As a substitute sometimes the double disc cultivator is used; in this machine the two rows of discs follow one another, and one row can be set at any angle desired. If the land is not fine enough for the seed drill to work across the path of the cultivator, then harrowing must follow the latter implement. Shallow working is done last for wheat in order that grain may have a sweetened top soil in which to germinate and get a good start in life, and also that the roots may find a firm condition in the subsoil.

Manuring artificially other than liming has not been largely experimented with hitherto, but it has been shown that phosphates in many cases are likely to be exhausted after a few years of heavy cropping, especially on the lighter soils.

Sowing.—Drilling in seed is better when the soil can be got into a fine state of tilth, but in wet seasons broadcasting may have to be resorted to. The quantity of seed used when sown by drill at the beginning of June should be about 50 lb. per acre, and three weeks later at the rate of 60 lb. per acre; as sowing early is not recommended, thick sowing is practised and early maturing is hastened. If grain is broadcasted, about 90 lb. of grain should be sown, say, for the middle of June. Too much rolling in New England is not desirable as land consolidates quickly enough without; but when rolling is required to break down clods, harrowing should immediately follow the operation—frequent harrowing in dry weather during growth of crop up to 5 inches high is advised.

Treatment for Smut.

GEO. L. SUTTON, Wheat Experimentalist.

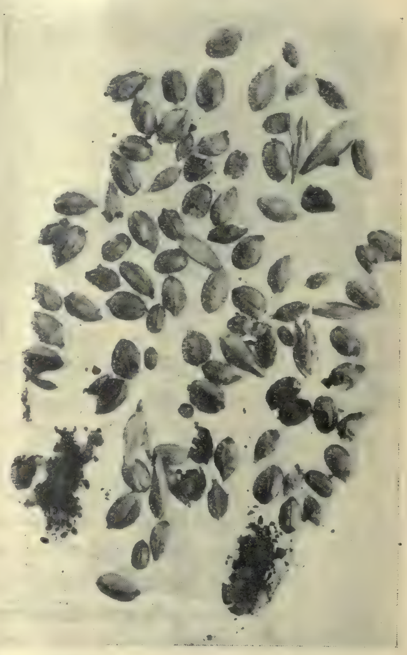
The wheat-grower is troubled with two pests known as Smut. They are Bunt or Stinking Smut, and Loose or Flying Smut. When, however, the farmer talks about "smut," he is almost without exception referring to Bunt or Stinking Smut, so called from the objectionable smell it has, and which is quite noticeable even if only a little be present in a large quantity of grain.

There are considerable differences between the two smuts; but, from the wheat-grower's standpoint, the chief one is that "smut" (Bunt) can be readily prevented by treating the seed-wheat before it is sown, whilst "loose smut" requires special treatment of the seed for its prevention in the resulting crop.

As "loose smut" requires special treatment of the seed-grain for its prevention, the most practical way of getting rid of it, after it has made its appearance on a farm, is to use for seed only grain which is known, as the result of an examination of the growing crop at the proper time, to be entirely free from this disease. *To determine whether "loose smut" is present in a crop the examination should be made when the plants are flowering.*

The chief (almost the only) cause of "smut" is the sowing of seed which has healthy spores adhering to it. It follows, therefore, that if the vitality of these spores can be destroyed, or if the plants resulting from the germination of the spores are destroyed, that the grain crop will be "clean." Methods have been introduced for successfully destroying the vitality of the spores, but no method has yet been devised for killing the "smut" plants after they have germinated. Occasionally, as in the case of self-sown crops, the natural conditions prevailing at the time the seed is planted are the cause of a "clean" crop being produced from untreated smutted seed; but to depend upon this chance method of obtaining clean crops is very unwise and likely to lead to disappointment. It is far wiser and more businesslike to destroy the vitality of the spores, and thus prevent them growing.

Whilst all the methods recommended for treating seed-grain will destroy the spores which have become free from the bunt-balls, NONE OF THEM IS EFFECTIVE FOR DESTROYING THE SPORES WHICH ARE CONTAINED IN UNBROKEN BUNT-BALLS. IT IS THEREFORE NECESSARY, IF ANY TREATMENT IS TO BE EFFECTUAL, THAT THE UNBROKEN BUNT-BALLS BE EITHER REMOVED OR BROKEN BEFORE THE SEED IS "PICKLED." If this is not done, the bunt-balls, during the subsequent operation of planting, are likely to become broken, and their healthy, vigorous contents dispersed over the treated grain, thus nullifying the effect of the treatment; for the effect of the treatment is to destroy the spores adhering to the grain; it does not render the grain immune to the attacks of "smut."



Bunt Balls. The "pickle" has no effect upon the spores contained in the unbroken ones.

It has been calculated that in a single bunt-ball, no larger than a

grain of wheat, there are about 4,000,000 spores, each of which is capable of causing one wheat-plant to be smutted. In a bushel of wheat there are 600,000 to 1,000,000 grains. There are, therefore, in a single bunt-ball enough spores, if regularly and evenly distributed, to provide each grain in a bushel of wheat with from four to six spores. The great necessity for removing or breaking the bunt-balls, so that the fungicide can act upon their contents, is obvious.

It is easier to remove the bunt-balls than to ensure that all are broken, and, fortunately, this can be done without any great difficulty. Bunt-balls are lighter than wheat and float in water, so that if the wheat to be treated is poured slowly into the "pickle," and in such a way that the bunt-balls will not be carried down by the grain, they will float on the top, and can be skimmed off and destroyed. As a further precaution, and in order to release any bunt-balls which may have been carried down by the grain, the grain should be stirred or raked; this is also likely to break up any partially-broken bunt-balls which have sunk and become soft.

Until bunt-resisting varieties are produced, and are in general cultivation, it is advisable to assume that all seed is more or less smutty, and requires to be "pickled," for, seeing that the spores are so minute, it is quite possible for enough to be present on the seed grain to cause considerable damage in the resulting crop, and yet for their presence to escape notice.

The Bluestone Treatment.

The most popular fungicide for treating seed-grain, and the one in most general use in this State, is *Bluestone* (copper sulphate). The efficacy of this fungicide depends upon bringing the "smut" spores in contact with a solution of bluestone for a sufficient length of time to destroy their vitality. Various plans are adopted for attaining this object. Whatever method is adopted, it should be done with sufficient thoroughness to ensure that no spores escape coming into contact with the fungicide long enough to destroy their vitality. A weak solution requires a relatively longer time to destroy the spores than a strong one does. At one time it was the common practice to "steep" the seed in a weak solution ($\frac{1}{2}$ per cent.) for twelve hours, but this method has now been almost superseded by methods which require the seed to be "steeped" for a few minutes—three to five—in a stronger solution of, say, 2 per cent. The details of some methods for treating seed-grain with bluestone are as follows:—

1. Make a solution by dissolving 1 lb. of bluestone in 5 gallons (50 lb.) of water, thus making a 2 per cent. solution. Soak the seed for five minutes; allow the seed to drain, and then immerse the wet grain in lime-water for two or three minutes. When *thoroughly dry* the grain can be planted. Unless thoroughly dry, the seed will not run freely through the drill.

   Instead of immersing the grain in lime-water after its treatment with bluestone, it may be sprinkled with air-slacked lime or wood ashes, which will help to dry it, but this latter method is not recommended when the seed is to be drilled in.

2. Make a solution by dissolving 1 lb. of bluestone in 1 gallon of water (that is, a 10 per cent. solution), and sprinkle this over the contents of a bag of wheat which has been previously emptied on to a wooden floor. During the operation of sprinkling, the wheat should be turned over several times to ensure the grains being evenly and regularly wetted.
3. Make a solution by dissolving ½ lb. of bluestone in 10 gallons (100 lb.) of water. Soak the seed for twelve hours, then dry and sow.

The first method is gradually becoming general, though in many cases the supplementary treatment with lime-water is omitted. It is rare to find a farmer adopting the third method, and those who use the second method are

Pickling Wheat with Bluestone.

becoming comparatively fewer each year. The actual details of the application of this method vary on different farms, and depend to some extent upon the conveniences available and the ingenuity of the operator. The plan illustrated is a very common one. The wheat, about 2 bushels at a time, is placed in loosely-tied "butts," and then, by means of a lever, is lowered into the solution, and after remaining in it the necessary time it is raised on to a sloping bench or trough, where the superfluous liquid can drain back into the cask. When the draining is complete, the "butt" is again lowered, by means of the same lever, into the lime-water contained in an adjacent cask, and after remaining for two or three minutes is raised out again and allowed to drain, but in such a position that the superfluous moisture does not run back into either of the casks.

Another method adopted on some farms is to place the seed-wheat, either loose or in bags, in elevated casks or troughs, and pour the bluestone solution over it. After it has remained on the wheat the necessary time it is run off into another cask or trough placed in a lower position. The troughs used are often made of hollow logs.

Drying.

After the seed has been treated, it requires some drying before it can be planted with a drill. If the seed has been treated with bluestone only (the supplementary treatment with lime-water having been omitted), and is to be planted within a reasonable time—say, within a week—all that is necessary is to place the "butts" where they can drain freely, when the seed will be ready to sow any time after a few hours. If the planting is not to take place for some considerable time, or if the seed has been treated with lime-water, as well as bluestone, it is necessary to dry it thoroughly. This can be done very expeditiously by spreading it out in a thin layer on a sheet or on a floor.

Many farmers go to a considerable amount of *unnecessary* trouble to obtain boiling water in order to dissolve the bluestone used in making up the solutions. Bluestone will readily dissolve in cold water, if treated in the proper way, which is as follows:—The necessary bluestone, after being weighed, should be suspended in an open bag *just below the surface* of the required quantity of water. In a few hours, even in the very coldest weather, the crystals will dissolve without any further attention. If, however, the crystals are placed at the bottom of the vessel containing the water, it will be weeks before they dissolve, unless the water is heated and agitated.

Bluestone when used alone, and not in combination with lime or lime-water, very injuriously affects the germinating power of the seed. Under some conditions, as much as *half the seed treated is destroyed,* or the vigour of the resulting plants so weakened that they are practically valueless. The *ill-effects* can be almost *entirely prevented* by sprinkling the treated seed whilst wet with air-slacked lime or wood ashes, or by immersing it for a few minutes in lime-water. Lime-water is made by mixing *freshly-burnt* (lumpy) lime in water, say 2 lb. of unslacked lime in 20 gallons of water. If freshly-burnt lime is not available, the seed should be sprinkled with air-slacked lime or wood ashes. AIR-SLACKED LIME IS NOT SOLUBLE IN WATER, AND THEREFORE LIME-WATER CANNOT BE MADE BY MIXING AIR-SLACKED LIME AND WATER TOGETHER.

An advantage of the bluestone treatment is that the bluestone solution does not deteriorate, but it can be used over and over again during the whole season. The quantity in the cask or other vessel becomes less on account of a certain quantity being absorbed by the wheat treated—about 1 gallon for each bushel treated. The quantity used can be replaced from time to time by adding a definite quantity of water, say 5 gallons (50 lb.), and a definite (weighed) quantity of bluestone, say 1 lb. All that is necessary is to pour the requisite quantity of water into the cask or trough some hours before it is required, and then suspend the weighed quantity of bluestone just below the surface of the liquid. The vessels used for holding the bluestone solution should **not be constructed of metal,** nor should metal be used in the construction of any part likely to come in contact with the solution.

CLARENCE RIVER.

A. H. HAYWOOD, Manager, Grafton Experiment Farm.

IT is remarkable that in the closely-settled Clarence districts practically no attention is paid to conservation of fodder and no provision is made for a bit of winter feed of any kind beyond an odd patch of sugar-cane that some farmers set aside for consumption when the cattle have devoured all that Nature provides.

There is, perhaps, no district in the State able to rival the Clarence in respect of the wide range of fodder crops which can be grown successfully without any extraordinary trouble or expense. Nevertheless, the denuded maize paddocks are all that the stock have to depend upon during several months of the year. From an agricultural point of view turning maize paddocks into cow-walks for long periods is fatal to future crop returns, as the constant trampling, especially in a wet time, ruins the texture of the soil, and the bad effects are felt in some cases for years after. This applies particularly to heavy or clayey soils.

There is no harm in turning the cattle in for a week or so. Then they should be turned out, and the cornstalks chopped up and turned under. If the land is not to be utilised for cropping until the spring the winter fallow will ensure increased yields in the succeeding crops.

Where provision has been made for fodder crops any surplus can be best used for silage. When filling the tub-silo, experience has taught that the two main points to be kept in mind are—

(1) The equal distribution of fodder in silo;

(2) The consolidation of the fodder round the edges while filling.

This, in practice, demands that three men should be constantly at work on the silo while being filled, two to tramp round the edges and one to fork the material round from the centre, where it has been directed from the elevator through a shoot made of sacks sewn together.

Green Fodder and Hay.—The macaroni wheats can now be sown and will give a large yield of green feed—are rust-resistant, and may be used for hay, if cut at the right stage. It is always best to combine a crop of the pea or bean family with cereals for fodder. Algerian oats are to be recommended for hay in this district. Rotation of crops should always be kept in mind. Hay crops can be worked in with maize crops on many holdings. Special attention should be paid to the areas intended for potatoes, and, where practicable, the question of raising early crops of vegetables for the Sydney market should be taken up. It frequently happens that quite a tidy sum can be made from a chance crop in a district like this where our season is so much earlier than other vegetable-growing districts.

MOREE.

A. E. DARVALL, Manager, Moree Experiment Farm.

WHEAT and oats may be sown this month for hay crops. The harrow should be kept going in crops already up until they reach a height of 9 or 10 inches. After they reach that height they cannot be touched until they are reaped, so it is as well to get a loose mulch in your ground whilst you can. Never leave anything to chance. Always farm on the principle that there

is sure to be a dry spell ahead of you, and if a wet one comes you will still be on the right side, as the rain will penetrate the soil that has been worked, whereas it will run off a hard and packed surface.

On irrigated areas the crops should have an irrigation if they require it. But if there is sufficient moisture in the ground, conserve it by harrowing. Remember that too much irrigation is as bad as, if not worse than, none at all; plants require air as much as we do, and a water-logged soil has had all the air driven out of it.

Reminders for June.

Fallow at the earliest opportunity the land that you intend to put into maize, lucerne, grasses, etc., in the spring, especially land that has couch in it. Frost is the only thing that will kill couch. Leave your land in as rough a state as possible, and let the winter frosts, rain, sun, and air get well into it—they are better than any implements yet invented for working our soil.

Winter vegetables can still be planted out and seed grown for a succession. Seed-beds should be arranged so that they can be covered at night, in case of frost. Gradually harden off the young plants by reducing, by degrees, the covering before planting out.

HAWKESBURY.

H. W. POTTS, Principal, Hawkesbury Agricultural College.

THE preparations for the Royal Agricultural Society's Show last month entailed a break in farming operations. Special efforts were put forth to excel all previous records. The Hawkesbury Valley farmers made a notable display in several sections, and secured more than the usual number of champion and first prizes in the sections for horses, cattle, and farm produce.

Many of the exhibits were of exceptional quality, and reflected the possibilities of the district under favourable weather conditions.

As usual the College and its farm were fully represented. Special literature dealing with the exhibits was distributed, and every opportunity was seized by the staff to impress the educational aspect of the display on the minds of the numerous and interested visitors. A concensus of opinion from visitors and staff points to the necessity for more room in the Department's pavilion and a better site.

The conditions for favourable sowings of winter cereals during the past month have not been satisfactory.

The rainfall for March and April is under half an inch. The February rains afforded moisture to germinate the early crops. We are now anxiously

looking for the autumn rains to maintain the vigorous growth. One has some hesitation in giving definite directions in preparing for and growing several crops with the existing outlook.

Wheat.—The main crops, both for hay and wheat, should be sown this month. In the former case, the best varieties are Zealand, John Brown, Tarragon, Rymer, Thew, Plover, Dart's Imperial, and Bobs.

Our past experience points to Thew, Plover, and Bobs as being reliable varieties and heavy yielders.

Although small areas are sown for grain owing to the prevalence of rust, the inclination is to extend them and grow more, seeing there is better prospects of securing a clean crop than formerly. It is found that Bobs gives the most reliable crop. The last sowings of the Durum wheats may be made. It has to be remembered that these very hardy and rust-resistant wheats have their good uses for hay, green fodder, and grain. In contrast with other varieties they are an assured crop under any conditions, and hence it is a safeguard against an adverse season to have an area under macaroni wheats. Farrer's Durum, Medeah, and Sarragoda are recommended as suitable for this district.

Oats.—The chief sowings are to be made now for the season.

In the selection of land for this crop, the soil need not be quite so good as that chosen for wheat or barley. The plant is robust and vigorous, and will thrive with less cultivation.

The most favoured variety is Algerian. It has acquired a lasting reputation as a quick grower, and possesses rust-resistant qualities.

Another variety worthy of attention is Amarilla. It will vie with Algerian in robustness and easy growth with a heavier yield.

White Tartarian and Dun oats have given good results in this valley.

Barley.—Further sowings of barley for green fodder to be ready for the cows in September may be made this month. Cape Barley is the most certain cropper, and, if intended for dairy stock, the addition of one-fifth seed of tares or peas will form an enriching element to the forage in addition to that of maintaining fertility in the soil. Where the crop is intended for malting purposes, then sow English Chevalier or Carter's Prize Prolific.

Rye.—This crop has always proved a safeguard against a bad season in this district, especially for green feed in the early spring. It has its value also for straw and grain. The attractive feature of the crop is its hardiness and capacity to provide a certain yield on the poorest of our uplands. It only requires half the manure taken up by wheat. As a green feed, if sown now, it will be ready for the stock in August. The heaviest frosts here fail to check its growth. Being perennial in habit, the stubble from rye, with a favourable spring, affords a good crop of green feed. Emerald and Thousand-fold are the best varieties.

Turnips and Swedes.—During the early part of the month, the last sowings for the season may be put in, should sufficient rain fall.

Rape.—In this district, where maize and sorghum are so largely grown, rape forms an excellent crop in the rotation to be eaten off by sheep or pigs.

Further sowings may be continued this month. The crop is ready for grazing in eight weeks under favourable conditions.

Tares or Vetches.—The last sowings for the season may be made, either with oats or barley for green feed, or alone as green manure in the orchard, or as a cover crop.

Field Peas.—As a rule, this crop is not a success in this district, but with a moist winter good crops have been grown. They are a most useful crop for pigs, and also form a valuable green manure for restoring impoverished soils.

Onions.—There are many plots on the Hawkesbury River where onions may be grown as a crop. So much depends on the constant attention being devoted to the plant, in keeping the area clean and constantly cultivated. The market for onions is invariably a paying one. Should there be enough moisture, the late crops can be sown this month, and will do well. Once the plant is established it is surprising how the roots will grow to find moisture, and in aiding the plant to do this, it is essential to have thorough and deep cultivation.

Carrots and Parsnips.—For feeding stock and table use, these excellent root-crops should have attention, and small sowings may be continued.

Jerusalem Artichokes.—Where it is intended to use these for the table, they may be dug this month, dried carefully, and stored in dry sand under cover. If intended for pig fodder, it is best to hurdle off a small area and allow the sows, after weaning their litters, to forage the roots for themselves.

Sweet Potatoes.—The sweet potato crop this season has proved heavy. Splendid crops have been grown. The tubers should be dug now, and if correctly stored, will keep in good order for several months. The first evidence of ripeness is when the vines begin to die, and harvesting operations should follow. Cut the tuber, and if the surface dries white and does not develop a dark tinge around the margins it is ripe enough for use. The flavour is spoiled by severe frosts, but the tubers have been known to lie in the ground and keep well until August.

Reminders for June.

Now is the time to start collecting the manure from the stables, cow-sheds and yards, in order that a good supply may be available for spreading on the land that is to be roughly ploughed next month (June) in preparation for the main crop of potatoes, and also early maize. Where there is couch a good shaking up in June, and consequent exposure to frosts, will thin it out considerably as well as mellow the soil. One of the greatest drawbacks to production of uniform tubers is harsh soil. The good effects of frost on roughly-ploughed land are thoroughly well known to every farmer, but it is unfortunately the fact that a good many people do not avail themselves of its good offices, but let the land lie set until a week or so before it is put under crop.

Orchard Notes.

W. J. ALLEN.

May.

Candied Peel.—Those who intend making any peel should see that it is soaked in the brine for at least four weeks, and that when taken out it is soaked in fresh water for two days, changing the water after the peel has been in it for twenty-four hours. Boil the peel for five minutes, and then place in a syrup of a density of about 14 degrees Beaumé, where it may be allowed to remain seven days, after which it may be immersed in a syrup of a density of 18 degrees to 20 degrees Beaumé, where it may be allowed to remain another week. The density of the syrup may be increased by four degrees for three succeeding immersions, and in the last syrup it may be allowed to remain for as long as three months if desired, as the longer it remains the better it appears to get, according to tests which we have carried out. A Beaumé saccharometer, or an instrument that will serve practically the same purpose, can be obtained from 7s. 6d.

Refilling old orchards.—Refills in deciduous orchards should be planted as early as possible.

Passion fruit.—Keep the fruit picked up as it falls, as it is then in its best condition. Grade it nicely, and pack it in rows in the boxes. If growers are exporting any other fruit, it would be a good plan to send a few cases of passion fruit along in order to test their carrying quality, as, if once we can successfully land this fruit on the markets of the old world and get it well introduced there, there should be an unlimited market for it, and there are thousands of acres of land near the coast on which this plant does well, and where, with proper attention, it produces heavy crops of fruit annually. Unfortunately, up to the present the trial shipments we have made have not all turned out satisfactorily, but we hope in time that the difficulties may be overcome, and we may yet create a demand for this delicious fruit.

Nursery stock.—The wraps on all budded nursery stock may be removed any time now.

Wherever it is necessary to enclose the orchard with wire-netting—and I am sorry to say that this is a precaution which cannot be overlooked in many parts of the State—it is best to use a good wide netting with small mesh at the bottom, as it is wonderful through what a small mesh a young rabbit will get as well as how high a fence he will scale; therefore, if the orchardist wishes to preserve his trees from the onslaughts of these pests, he must see that the orchard is securely enclosed.

I have to thank Messrs. H. S. Jones, of Penrose, Hector Robertson and Henry Street, of Mount Keira, Mr. Moulder, of the Oaks, and others, for

sending me very fine specimens of the following apples:—Buncombe, Five Crown, Rome Beauty, Jonathan, Northern Spy, and Beauty of Australia.

Get ready for Planting and Pruning in June.

Any evergreen fruit trees, oranges, lemons, loquats, or guavas, that are required should be planted out as soon as possible now, and some provision made for their protection against frost unless the situation is well sheltered.

Next month (June) is a favourable time for planting out summer fruit, and apples, and pears. It will pay to get the land ready now, and a little well-rotted manure or leaf-mould placed in readiness for mulching.

Have the area to be planted worked to an even depth; do not so manage things that when the trees are planted they will stand in pits of water-logged soil.

A special work on pruning and winter spraying is now in preparation, and will, it is hoped, be ready by the time this season's operations commence.

Choosing Varieties of Fruits to Plant.—It will repay anyone intending to plant fruit trees to consult the Department of Agriculture, in order to ascertain which varieties are likely to prove most profitable in any particular locality. At all the experiment orchards a very large number of different varieties of each class of fruit are grown side by side for comparative purposes, and the experience thus gained can be relied upon. The selection of vigorous young stock of the right kind for the locality selected for an orchard is of paramount importance, and if due precautions are not taken at the outset, no amount of careful cultivation or pruning will avail.

In writing for advice on this very important matter, it will be well to furnish precise particulars as to locality, aspect, nature of soil and subsoil, distance from train or boat, and anything else that may help the Fruit Expert to decide promptly and satisfactorily the points at issue.

Seeing the time we have to wait before receiving monetary returns from fruit trees, it is well also to avail of the most reliable advice as to preparation of the soil and every phase of after treatment, so that the young trees may be pushed forward to maturity without check.

The Fruit Expert will be only too happy to answer any questions submitted to him, and if timely notice be given and circumstances will permit, he will either pay a personal visit or send a competent assistant to give practical instruction on the spot.

Fastening for securing the Bandages to the Trees for catching the Grub of the Codlin Moth.

While in the Tangmangaroo district, Inspector Johnston was shown a very handy fastener for securing to apple, pear, and quince trees the bandages for catching the grub of the codlin moth. This handy little piece of bent wire was invented by Mr. J. Boulding, who is using it in preference to nails, string, &c. It is easily made, lasts well, cannot readily be

Fig. 1.—The Fastener.

post, and is easily attached to the bandage. It is one of the best fasteners I have seen, and when it becomes known I feel sure the fruit-growers will use it largely.

These fasteners can be made during the long winter nights, so that they will be in readiness for use when the season for bandaging the trees comes round again.

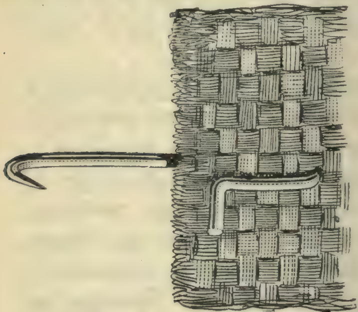


Fig. 2.—The Clip in position.

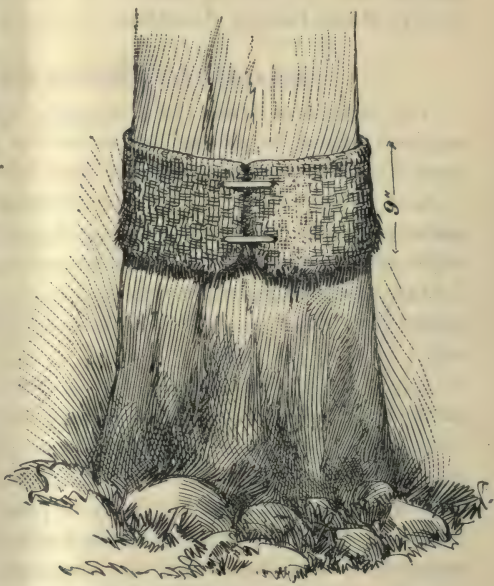


Fig. 3.—A Codlin Moth Bandage secured by means of Mr. Boulding's invention.

The Blondin and Hoover Apples.

The following are the descriptions of the Blondin and Hoover Apples which are illustrated on the coloured plate:—

Blondin.

Growth—fairly vigorous.
Age of tree—seven years.
Form—oblate conic.
Size—medium.
Colour—bright red in sun, greenish-yellow in shade; white dots.
Skin—fine.
Cavity—wide and shallow.
Colour of flesh—greenish and yellow.
Texture—tender, juicy.
Flavour—sub-acid, good.
Suitable for dessert.
Date of colouring—27th December, 1908.
Picked—3rd January, 1909.
Crop—good.

Remarks.—Diseases—free. A most promising early dessert apple. This variety may be recommended with confidence.

Hoover.

Blossoming date, 3rd October, 1908. Gathering, about middle of March. It forms a good, spreading, upright tree, fairly vigorous.

Form—roundish oblate.
Size—medium.
Colour—two distinct shades of red, with white dots a little russett.
Skin—very thick.
Cavity—wide, rough, and a little russetted.
Stem—medium.
Basin—shallow.
Eye—closed.
Flesh—yellowish, rather firm, coarse, tender, juicy, rich sub-acid.
Core—small.

Hoover is a regular cropper, and an apple that will sell on its colour alone. It is generally considered a cooking apple, but on the higher elevations develops into a very good dessert apple. At Yetholme, near Bathurst, this apple does exceedingly well, and brings very high prices in the Sydney market.

H. S. BURTON LITH.

ORIGINAL, DRAWN FOR THE AGRICULTURAL GAZETTE.

W. A. GULLICK, GOVERNMENT PRINTER.

APPLES.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1909.

Society.	Secretary.	Date.
Luddenham A. and H. Society	W. Booth	May 4, 5
Moree P. and A. Society	D. E. Kirkby	,, 4, 5, 6
Dubbo P., A., and H. Association	Fred Weston	,, 5, 6
Durham A. and H. Association, Dungog	C. E. Grant	,, 5, 6
Coonamble P. and A. Association	J. M. Rees	,, 12, 13
Kyogle P., A., and H. Society, Kyogle	S. J. Sargent	,, 12, 13
Hawkesbury District A. Association	C. S. Guest	,, 13, 14, 15
Central Australian P. and A. Association, Bourke	G. W. Tull	,, 19, 20
Walgett P. and A. Association	S. Smith	,, 19, 20
Nyngan and District P. and A. Association	....	,, 26, 27
Wilcannia P., A., and H. Society	E. G. Dollmer	,, 26, 27
Cobar P. and A. Association	D. H. Dunlop	June 2, 3
N.S.W. Sheepbreeders' Association	A. H. Prince	,, 30, July 1, 2, 3
Pastoral and Agricultural Society of Deniliquin	L. Harrison	July 15, 16
Hay P. and A. Association	G. S. Camden	,, 20, 21
Balranald P. and A. Society	A. Malcolm	,, 28
Peak Hill P., A., and H. Association	J. A. McIntyre	,, 28, 29
Narrandera P. and A. Association	W. T. Lynch	Aug. 4, 5
National A. and I. Association of Queensland	C. A. Arvier	,, 7 to 21
Corowa P., A., and H. Association	J. D. Fraser	,, 17, 18
Ganmain A. and P. Association	A. R. Bolton	,, 18
Forbes P., A., and H. Association	H. J. Brooke	,, 18, 19
Gunnedah P., A., and H. Association	M. C. Tweedie	,, 24, 25, 26
Murrumbidgee P. and A. Association, Wagga Wagga	A. F. D. White	,, 24, 25, 26
Parkes P., A., and H. Association	G. W. Seaborn	,, 25, 26
Northern A. Association, Singleton	F. A. Bennett	,, 25, 26, 27
Grenfell P., A., and H. Association	Geo. Cousins	,, 31, Sept. 1
Junee P., A., and H. Association	T. C. Humphrys	Sept. 1, 2
Lockhart A. and P. Society	H. Parnaby	,, 7, 8
Young P. and A. Association	J. F. Dwyer	,, 7, 8, 9
Cudal A. and P. Society	P. Gavin	,, 8
Ariah Park A., H., and I. Association	A. T. White	,, 8
Germanton P. and A. Society	James S. Stewart	,, 8, 9
Cootamundra A., P., H., and I. Association	W. E. Williams	,, 14, 15
Albury and Border P., A., and H. Society	W. I. Johnson	,, 14, 15, 16
Canowindra P., A., and H. Association	J. J. Finn	,, 21, 22
Temora P., A., H., and I. Association	John Clark	,, 21, 22, 23
Henty P. and A. Society	P. H. Paech	,, 28, 29
Wyalong District P., A., H., and I. Association	Thos. A. Smith	,, 28, 29
Lachlan P. and A. Association	T. Cadill	Oct. 22
Lismore A. and I. Society	T. M. Hewitt	Nov. 17, 18, 19
Tweed and Brunswick A. Society	F. A. Wildash	,, 24, 25

1910.

Society.	Secretary.	Date.
Guyra P., A., and H. Association	P. N. Stevenson	Feb. 22, 23
Tumbarumba and Upper Murray P. and A. Society	E. W. Figures	Mar. 9, 10
Blayney A. and P. Association	E. J. Davis	,, 15, 16
Inverell P. and A. Association	J. McIlveen	,, 15, 16, 17
Upper Hunter P. and A. Association (Muswellbrook)	J. M. Campbell	,, 16, 17, 18

Agricultural Development.

EVERY one interested in the agricultural development of the State will find food for reflection in the report which ex-President Roosevelt submitted recently to the United States Congress in respect to the findings of his Commission on Country Life.

The investigations of the Commission covered a wide field—farmers and their wives came from forty States and territories to give personal evidence; the Department of Agriculture sent out 120,000 sets of question papers, and no stone was left unturned to ascertain the accurate social and industrial condition of the farming community of the United States.

Ex-President Roosevelt says:—"The object of the Commission on Country Life was not to help the farmer raise better crops, but to call his attention to opportunities for better living on the farm. If country life is to become what it should be—one of the most dignified, desirable, and sought after ways of earning a living—the farmer must take advantage not only of the agricultural knowledge at his disposal, but of the methods which have raised and continue to raise the standards of living and intelligence in other callings."

Despite the fact that in the general sense the all-round conditions of country life had improved, Mr. Roosevelt pointed out that "farming does not yield either the profit or the satisfaction that it ought to yield and may be made to yield. There is discontent in the country, and in places discouragement. The movement to the towns, though less than formerly, is still strong. . . .

"It is helpful to promote discussion of ways in which the people can help themselves. There are three main ways in which the farmers can help themselves, viz.:—better farming, better business, and better living on the farm . . . . Whatever the State may do towards improving the practice of agriculture, it is not within the sphere of any Government to reorganise the farmer's business or reconstruct the social conditions of farming communities.

"It would be idle to assert that life on the farm occupies as good a position in desirability and business results as the farmers might give it if they chose. One of the chief difficulties is the failure of country life, as it exists at present, to satisfy the higher social and intellectual aspirations of country people. Whether the constant draining away of so much of the best elements of the rural population into the towns is due chiefly to this cause or to the superior business opportunities of city life may be open to question. But no one at all familiar with farm life can fail to recognise the necessity for building up the life of the farm upon its social as well as upon its productive side. It is true that country life has improved greatly in attractiveness, health and comfort, and that the farmers' earnings are higher than they were. But city life is advancing even more rapidly, because of the greater attention which is being given by the citizens of the towns to their own

betterment. For just this reason the introduction of effective agricultural co-operation throughout the producing districts is of the first importance. Where farmers are organised co-operatively they not only avail themselves much more readily of business opportunities and improved methods, but it is found that the organisations which bring them together in the work of their lives are used also for social and intellectual advancement. The problems of farm life have hitherto had too little attention. The neglect of them has not only held back life in the country, but also lowered the efficiency of the whole nation.

"The welfare of the farmer is of vital consequence to the welfare of the whole community. The Commission has tried to help the farmers to see clearly their own problem and to see it as a whole; to distinguish clearly between what the Government can do and what the farmers must do for themselves; and it wishes to bring not only the farmers but the nation as a whole to realise that the growing of crops, though an essential part, is only a part of country life. Crop-growing is the essential foundation, but it is no less essential that the farmer shall get an adequate return for what he grows; and it is no less essential, indeed it is literally vital, that he and his wife and his children shall lead the right kind of life.

"To improve our system of agriculture seems to me the most urgent of the tasks that lie before us. But it cannot, in my judgment, be effected by measures which touch only the material and technical side of the subject; the whole business and life of the farmer must also be taken into account."

"The Agricultural Gazette."

THE *Agricultural Gazette* is distributed free of cost to *bonâ fide* agriculturists desiring it. Rural workers are invited to make application to be placed on the free list, stating at the same time the class of farming in which they are engaged, so that suitable literature not appearing in the *Gazette* may also be forwarded for their information. Secretaries of Agricultural and similar Societies are invited to forward the names and addresses of their members, giving similar information.

These applications should be addressed to the Under Secretary, Department of Agriculture, Sydney. The names of approved applicants will be added to the distribution list without formal intimation.

To all others, the terms of subscription are—

	Per annum. s	d.
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New Zealand and Fiji (by post)	5	6
British New Guinea "	6	0
All other places "	8	0

Remittance by Postal Note or Money Order should be made to the Government Printer, Sydney.

Exports and Imports.

H. V. JACKSON.

The quantity of rabbits and hares exported from New South Wales during the twelve months ended 31st December, 1908, amounted to 5,710,326 pairs, valued at £247,254.

Rabbit and hare skins exported equalled 3,020,902 lb., valued at £139,087, the total value of exports in frozen rabbits and rabbit-skins being £386,341.

The rabbits packed in New South Wales for export during 1908 totalled 466,094 crates, containing 11,186,256 single rabbits, and the hares packed totalled 2,415 crates, containing 28,980 single hares. The total number of crates of rabbits and hares packed was, therefore, 468,509 crates, equal to 5,607,618 pairs.

As usual, the larger quantity of rabbits were packed in the first half of the year, the quantity being as under:—

Period. 1908.	Rabbits. Crates.	Hares. Crates.	Total. Crates.
January to June ...	258,789	814	259,603
July to December ...	207,305	1,601	208,906
	466,094	2,415	468,509

Mr. W. Lane Mitchell, Tooley-street, London, has issued the following particulars of imports of frozen rabbits into the United Kingdom since 1902:—

Australian.	1908.	1907.	1906.	1905.	1904.	1903.	1902.
Crates ...	590,713	843,463	907,324	593,545	412,153	326,900	283,961

New Zealand.	1908.	1907.	1906.	1905.	1904.	1903.	1902.
Crates ...	105,868	97,323	94,920	94,231	137,448	186,816	194,766

Tasmania.	1908.	1907.	1906.	1905.	1904.	1903.
Crates ...	Nil.	3,038	18,063	18,415	34,952	25,113

Permits were issued under the Commonwealth Commerce Act covering goods for shipment as under:—

	1908—January to June. Packages.	1908—July to December. Packages.	Total.
Canned fruit ...	7,501	2,366	9,867
Fruit	36,736	102,226	138,962
Hares (crates) ...	579	2,710	3,289
Honey	55	84	139
Jam	2,620	3,529	6,149
Leather	4,807	6,568	11,375
Maize	66	50	116
Plants	460	433	893
Potatoes	16,441	11,872	28,313
Rabbits (crates) ...	220,354	258,290	478,644
Seeds	2,395	1,673	4,068
	292,014	389,801	681,815

Some exports oversea during 1908 :—

	Quantity.	Value.
Horses—No.	2,897	£77,183
Cattle ,, ...	687	9,111
Sheep ,, ...	10,080	14,074
Butter—lb.	18,542,770	875,671
Fruit—fresh (cental)	51,353	38,736
Wheat ,, ...	248,114	92,621
Flour ,, ...	354,331	170,382
Beef—lb.	725,823	9,069
Mutton and Lamb—lb.	44,626,353	522,232
Rabbits and Hares—pair ...	5,710,326	247,254
Meat (preserved)—lb.	7,305,150	138,945
Hides—No.	281,887	206,995
Skins—Sheep-skins—No. ...	2,453,109	287,404
Rabbit and Hare—lb. ...	3,020,902	139,087
Other	......	252,067
Tallow—cwt.	314,681	429,758
Timber	......	307,635
Wine—gal.	66,349	20,669
Wool—lb.	276,961,672	11,857,159

Imports of Poultry and Eggs into New South Wales during 1908.

Live Poultry.

Imported from	Quantity. No.	Value. £
Victoria	331	135
Queensland	160	34
South Australia	47,456	4,639
Western Australia	7	2
Tasmania	2	2
United Kingdom	82	155
New Zealand	7	10
Germany	5	5
New Hebrides	12	7
U.S.A.	1	1
Totals	48,063	4,990

Frozen Poultry.

	lb.	£
Victoria	33,207	1,332
Queensland	3,918	141
Totals	37,125	1,473

Eggs in Shell.

	Dozens.	£
Victoria	6,315	269
Queensland	207,718	8,370
South Australia	1,149,659	49,605
New Zealand	2	2
Hong Kong	6,780	188
Totals	1,370,474	58,434

These figures speak for themselves.

Exports of Poultry and Eggs from New South Wales during 1908.

Live Poultry.

Destination.	Quantity. No.	Value. £
New Zealand	307	357
Fanning Island	6	5
Fiji	378	160
New Guinea	79	23
Ocean Island	344	79
Caroline Islands	3	1
Marshall Islands	76	25
Neu Pommern	128	44
New Caledonia	10	8
New Hebrides	88	31
Kaiser Wilhelm Land	20	5
Philippine Islands	176	52
South Sea Islands	158	43
India	14	10
Totals	1,787	843

Frozen Poultry.

	Pairs.	£
United Kingdom	56	12
Cape Colony	144	81
Natal	430	171
Straits Settlements	460	180
Java	24	5
Neu Pommern	33	10
Philippine Islands	1,493	1,067
South Sea Islands	14	1
Totals	2,654	1,527

Eggs.

	Dozens.	£
New Zealand	569	96
United Kingdom	12	1
New Guinea	48	2
Ocean Island	1,305	95
Fiji	62	5
Marshall Islands	1,137	85
Neu Pommern	805	71
New Hebrides	140	10
South Sea Islands	458	35
Totals	4,536	400

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VOL. XX. PART 6 JUNE 2, 1909.

Agricultural Gazette of New South Wales.

Co-operation for Wheat-growers.

To what extent does it lie within the power of the wheat-grower to improve his position as a trader in a commodity that is now produced in excess of local requirements; in what way may the growers of the State co-operate to safeguard their interests against unfair tactics on the part of the mere speculator in foodstuffs?—are two questions that appear to be worthy of the consideration of producers.

The arrangement under which a great deal, if not all, of the wheat that leaves New South Wales' shores is marketed, is for the export buyer to pay the farmer straight out and take the shipping risks on his own shoulders. For this work his business organisation is very complete. His buyers scour the country long before the harvest, and with practised knowledge of most of the phases of output the campaign is arranged, and the money begins to change hands long before the last bag is filled.

The wheat-grower, as a trader, is handling a commodity for which the universal demand is practically unlimited, and this, on the one hand, places him at a certain advantage; but, on the other hand, his grasp of facts in relation to possible total output is not always equal to the systematic knowledge of the buyer, and besides, where so much of the grain is harvested straight into the bag and there is no place on the farm to store it safely, he has not much choice in the glutted market thus created between accepting the first offer or running up a bill for storage. Even where methods of harvesting permit of more advantageous selling conditions there are always the impetuous and the desperately hard-up producers who must obtain advances, who must seize the first chance of cash realisation, so that even if it should, on deliberation, be found to be a wise thing for growers, as a whole, to adopt in co-operation a certain course, there would always be some who would, by choice or of necessity, allow their produce to follow channels from which the mere speculator, if he sees fit, can take the lion's share of the spoils. In this and the matter of storage difficulties, the conditions of Germany, Austria, and France, despite the great disparity in areas and density of settlement, are not very different to ours. The same problems of glutted markets and disadvantageous sales through the majority of growers' urgent need to dispose of their grain immediately after harvest, confronted the farmers there until about fifteen years ago, when organised efforts were made to secure better control of their markets by the establishment of co-operative grain stores.

The organisation in Germany is centralised in a *Kornhäus Commission* (Store Committee), and the establishments vary from the immense one at Halle-sur-Saale, owned by rich proprietors and large farmers, to the small sheds in Bavaria. Between the store at Halle-sur-Saale, which can house 6,000 tons of cereals, and on which £17,000 is expended annually on

management, to the small ones in Bavaria and Wurtemberg there are infinite varieties, but they all possess machinery for cleaning the grain, and many of them drying machinery as well. The better ones have both granaries and silos, consisting of enormous wooden cisterns, having the lower part funnel-shaped. The cost of the buildings and machinery varies from 2s. 6d. to 4s. 6d. per cwt. of capacity, according to size and the improved mechanical appliances introduced. Experience seems to show that the best results are obtained by smaller stores (used for storage only) having a large central store for sales, and in this way a great deal of competition is avoided. The sales are effected in three ways: either at the sole risk of the co-operative store after a firm purchase from the farmer, by sale on commission, or at the average price of the year. Most of the German grain stores buy the cereals outright from the farmers and sell at their own risk. This involves either an immediate resale, abandoning the regulating of supplies to the markets—which is really contrary to the object of the institutions—or keeping the grain for some time, which might be ruinous in case of a heavy fall in prices. The sale on commission is better, and what seems the most worthy of encouragement is the sale at an annual average price, by means of which each member participates equally in the advantages of co-operation. In Austria the establishment of grain stores is more recent, and, as in Germany, the co-operative societies are grafted on to already existing agricultural associations, the membership of which in the Fatherland is equal to about the total population of New South Wales.

In both Germany and Austria it is affirmed that the movement has operated to the great advantage of medium and small farmers, as well as the general public, by regulating prices and improving the quality of grain, which practically all goes into local consumption.

At the Sale of Wheat Congress at Versailles in 1900, it was decided to establish similar co-operative grain stores in France.

In Canada, the United States, Argentine Republic, and parts of southern Russia, the initial storage difficulty is decreased by the elevator systems in operation; but it is to be feared that it is only in Canada, where elevators are regulated by the State, that the grower has much of a chance against the speculator, and even in Canada the necessitous man is exposed to precisely the same risks as elsewhere. Where our Dominion cousins do gain an over-sea market advantage is by confining themselves to a few desirable types which go abroad graded in a steady volume of uniform quality, which everyone understands and can rely upon.

Raise the General Standard of Production.

As we may be on the eve of a very radical change in our methods of handling wheat, some people may think the present time inopportune for any change in existing market methods; but there are a number of important things that can be done with profit to everyone concerned, be they growers or

handlers of New South Wales wheat. Every wheat-grower in this State can rest assured that in the big markets of Great Britain and elsewhere the best types of our wheats are held in such esteem that the only fault found with them is their scarcity. But growers must not forget that for general oversea trading purposes the *fair average quality* of the whole wheat output of the State is used as a basis, and the f.a.q. in comparison with the best that is grown is enough to make one's hair stand on end. Here we have a point that every grower, if he chooses, can do something to rectify, and since compliance with the eager demand of the oversea markets means general improvement in every detail of production, the desired result may be achieved more speedily and effectively by all growers in co-operation than by individuals each following his own devices. Raising the average quality of the grain to the highest possible level means increasing the competition for it.

This seems to be really the crux of the farmer's problem; for while, at present, at all events, few wheat-growers, individually or collectively, can expect to compete successfully on their own behalf with experienced and thoroughly well-equipped shippers, and with a three or four months' wait for cash returns, they can produce an article which will be eagerly sought. To be able to do this, every farmer must be able to command adequate plant in the first place, and groups of farmers have a better chance of getting, in co-operation, a greater purchasing advantage than any individual can hope for.

In the matter of implements, it is to be feared that there is not much chance of it being possible for even three or four farmers to share in the use of either planting or harvesting machinery; but it seems to stand to reason that if all the farmers in any given district were acting in co-operation, each could secure, by reason of the wholesale nature of co-operative transactions, a substantial concession in the cost, which would be to the manifest advantage not only of the strugglers but to the district, whose average quality is lowered by the inclusion of ill-grown or ill-saved grain.

It is generally admitted that the use of carefully selected and graded seed increases the yield. For this work to be done effectively, proper and fairly expensive machinery is essential. Might not this be another common ground upon which groups of farmers could co-operate; and would not the risk of bunt-infection, through treatment of seed from all classes of farms, cause the producers of clean grain to bring moral suasion to bear upon the producers of dirty grain to mend their ways, to the general improvement of the output of the district?

And in respect to the installation of cleaning and grading plant at some convenient centre, would the advantages to be derived from the handling and transportation of grain minus rubbish repay the cost of cleaning and re-bagging, or is the old system sufficient in itself, since, at present, at all events, the rubbish is weighed in and goes to swell the bulk? Perhaps it is; but do we always realise that the oversea miller—the final arbiter—may make a liberal allowance for it ever afterwards, and thus levy heavy toll on the fairly clean and the very dirty shipments alike?

Then, in relation to sacks—often the matter of speculation—might not farmers, as co-operative buyers, or even importers, secure for themselves substantial advantages?

So with manures, with twine, with practically everything required.

None of the things just enumerated are chimerical; all of them have been tried in one way or another in various parts of the world, where the stress of production and competition is keener than it is here. At any rate, if the only co-operation that is practicable at this stage is the sort that would lead all the farmers in a district of fairly even conditions to put their heads together to discuss such important matters as the best type of wheat to grow and the best way to grow it, so as to secure and maintain for their district's output a sound reputation, it would surely be of great benefit to themselves and to the State.

And when a beginning was made in this way, it would not take long for the shrewd men in their midst to realise how much advantage they could all derive by having at their hands for discussion all the latest information concerning the prospects of the world's markets and all other matters of business interest, as well as to watch the operations of the experiment farms, demonstration areas, and all other functions of the Department of Agriculture with a view to deriving from the information rendered available every point that will be to their advantage.

The Farmers and Settlers' Association of New South Wales is a standing example of a very important phase of co-operation among producers. It is thoroughly representative, and its functions are already wide and important, but is there any reason why such an influential body, with so many of the leading farmers of the State in its active membership, might not extend its scope to the end that New South Wales may have in effect a wheat-growers' co-operative association with a live branch in every suitable district, the main function of which would be to act in accord with the Department of Agriculture in the endeavour to raise the standard of wheat production? The association would have, by reason of the large number of experienced growers in its membership, a status that would command general confidence, and there is every reason to believe that general benefit would result from frequent conferences with the experts of the Department of Agriculture, organised visits to the demonstration areas and experiment plots, and by periodical local meetings to discuss and disseminate all available information concerning the probable supply of wheat in other countries, the trend of the markets after each harvest, and everything else affecting the welfare of the industry. The local branch might even constitute itself a distributing medium for all the latest statistical and technical information published by the Bureau of Statistics and the Department of Agriculture, and if someone or some body on the spot would see to it that every grower in a district was stimulated to recognise the profit to himself and the importance to the industry as a whole to be gained by the possession of up-to-date knowledge of affairs affecting him, and by the adoption of effective methods, the result must be general improvement of the fair average quality of New South Wales wheat.

It is highly probable, too, that if the first steps in co-operation can be taken on the lines that appear at present to be most practicable and suitable for our conditions, the benefits will be so apparent that before long the system may be extended to embrace the establishment of co-operative agricultural credit associations, which have done so much in other countries to help struggling producers through difficult crises, and contributed directly to maintaining uniformity of volume of supply, which is really almost of as much importance as high quality in produce.

BULK HANDLING OF WHEAT IN GREAT BRITAIN.

IN response to the request of the Minister of Agriculture, the Agent-General has forwarded a report on the Bulk Handling of Wheat in Great Britain. In summarising the information obtained the Agent-General states:—

All the English ports to which foreign and colonial wheat is shipped receive it in bulk and in bags, about 60 per cent. of the wheat imported being in bulk and 40 per cent. in bags. In London, Bristol, Glasgow, Liverpool, and Manchester, the larger proportion is received in bulk, while at Hull the proportions are about equal.

At all the principal docks where wheat is imported, except Hull, there are elevators, which enable the wheat arriving in bulk to be discharged from the ships with greater rapidity and less expense than the grain imported in bags. At Hull the wheat arriving in bulk is discharged into lighters and carried to the mills, of which the greater number are so situated that railway transit is not required. On the other hand, the railways possess practically no facilities for handling grain in bulk, and *wheat which requires railway transport has to be bagged at the port.* The dock-owners provide up-to-date machinery at the docks for this purpose, the cost of which has to be borne by the merchant. In some cases, when wheat arrives in bags, these are not strong enough to bear railway transit, and the wheat has to be re-bagged. The quantities of imported wheat handled by the railways is, however, comparatively small.

Ship-owners prefer that wheat should be sent in bulk, as there is economy of space, the discharge is more rapid, and is paid for by the merchant. The cost of freight is lessened by shipping in bulk, as the bags are paid for on the other system.

The merchants prefer the system of shipping in bags. Their chief reason appears to be that the wheat in bags is weighed in small lots of about 4 bushels, and on each occasion the merchant gets the benefit of the draft required to turn the scale, whereas bulk wheat is weighed in lots of one ton or more. They regard the slower rate of discharge from the ship as an advantage, as it gives them more time to dispose of the grain. In the port of London, the cost of discharging wheat in bags is paid by the ship.

Factors in Mark-lane believe that Australian wheat in bulk would not command quite so high a price as in bags, and some corn merchants consider there is some danger that the condition of the wheat would be adversely affected by transport in bulk; that there would be more danger from attack by weevils, and that the wheat would be more likely to suffer from natural heating. The damage done to wheat in bags from these causes is more confined, and can be located more easily.

Messrs. Berry, Barclay & Co., a firm of London merchants interested in the Australian grain trade, believe that the extra sea risks, if it were handled in bulk, would enhance the rate of insurance. Some of these objections must be considered more or less fanciful, seeing that Argentine wheat, which has somewhat similar characteristics to Australian, is brought here in large and increasing quantities in bulk, and I can find no complaints in regard to the manner in which it is handled. On the whole, there appears to be a saving of about 2s. per ton in this market in bulk shipments, but I should be disposed to say that otherwise there is little to choose between the two systems.—T. A. COGHLAN.

The report in full is being reproduced as a Special Bulletin (No. 21), which may be had on application to the Under Secretary, Department of Agriculture, Sydney.

Notes on the Wheats competing for Prizes at the Royal Agricultural Society's Show, 1909.

F. B. GUTHRIE.

At the recent Royal Agricultural Society's Show the prize-money in the wheat section was increased considerably over that of previous years, the sum of £82 having been allotted for this purpose, as against £43. This sum further included prizes for the best collection of Farrer wheats, and of wheats other than Farrer wheats.

Although the value of the prizes was thus nearly doubled, it is to be regretted that the number of competing samples was very slightly increased.

The quality of the grain exhibited shows an improvement over that of former years, and this is notably the case in the hard and medium hard classes. The judging was carried out as in previous years. The bushel weight of all samples was taken, and after careful inspection, to eliminate the inferior wheats, those which were eligible for prizes were milled on the small model mill of the Department of Agriculture, the prizes being finally awarded in accordance with their behaviour in the mill.

The judges were Messrs. R. W. Harris, head miller, Gillespie Brothers, Anchor Mills, Sydney, and F. B. Guthrie, with whom was associated Mr. G. W. Norris, who carried out the details of the milling.

The following table gives the weight per bushel of all wheats, and the milling results of the best wheats in each class.

In the table of milling results the figures within brackets represent the numbers obtained on milling the sample, the others being the marks assigned.

WEIGHTS PER BUSHEL.

Catalogue No.	Name of Wheat.	Weight per bushel, lb.	Catalogue No.	Name of Wheat.	Weight per bushel. lb.
		Class 761 (Macaroni).			
4338	Indian Runner	64½	4340	Macaroni	61¾
4339	Cretan	62½			
		Class 762 (Hard wheat).			
4342	Manitoba	64½	4345	Manitoba	63
4343	Comeback	62½	4346	,, ...	63½
4344	Manitoba	63¼	4347	,, ...	63¾
		Class 763 (Medium hard wheat).			
4348	Thew	63	4351	Bobs	66¼
4349	Comeback	65¾	4352	,, ...	65¼
4350	,, ...	63¼	4353	,, ...	65¾
		Class 764 (Soft wheat).			
4354	Petatz Surprise	67½	4360	Schneider	65
4355	Steinwedel	66¼	4361	Federation	63½
4356	Federation	64½	4362	Jade	66
4357	Zealand	65½	4363	Plover	63½
4358	Budd's Early	65	4364	Cumberland	66
4359	Ward's Prolific	64½			

Catalogue No.	Name of Wheat.	Weight per bushel, lb.	Name of Wheat.	Weight per bushel, lb.
	Collections of Five Farrer Wheats.			
4366	Rymer	62¾	John Brown	61¾
	Tarragon	64½	Cleveland	62
	Federation	63		
	Average—63.			
4367	[*Five Samples Unnamed.*]			
4368	Bobs...	65¾	Plover	62½
	Comeback	65¼	Federation	64
	Cumberland	66¼		
	Average—64¾.			
	Collections of Five Wheats other than Farrer.			
4369	Purple Straw	65¼	Dart's Imperial	63¾
	White Tuscan	64¼	Manitoba	63¾
	Steinwedel	64¾		
	Average—64¼.			
4370	Dart's Imperial	63¾	Purple Straw	63
	White Lammas	64¼	Manitoba	62½
	Steinwedel	63¼		
	Average—63¼.			

Results of Milling Tests.

Catalogue No.	Appearance of Grain.	Weight per bushel.	Ease of Milling.	Percentage of Flour.	Colour of Flour.	Percentage of dry Gluten.	Strength.	Total.
Maximum Marks.	10	15	10	10	15	20	20	100
				Class 761 (Macaroni).				
4338	10	[64½] 15	10	[69·5] 10	15	[10·91] 20	[48] 20	100
				Class 762 (Hard Wheats).				
4346	10	[63½] 15	10	[72·8] 10	14	[14·66] 19	[53·6] 20	98
4365	8	[62¾] 14	10	[73·2] 10	15	[16·36] 20	[54] 20	97
4347	7	[63¾] 15	10	[71·7] 10	14	[14·21] 19	[53·8] 20	95
				Class 763 (Medium Hard Wheats).				
4353	10	[65¾] 14	10	[74·3] 10	15	[10·43] 17	[54] 20	96
4351	9	[66¼] 15	10	[75·4] 10	14	[11·48] 18	[53·6] 19	95
4352	8	[65¼] 13	10	[74·4] 10	12	[13·7] 20	[53] 19	92
				Class 764 (Soft Wheats).				
4354	10	[67½] 15	10	[72·0] 10	14	[8·27] 18	[47] 18	95
4364	8	[66] 12	10	[71·7] 10	12	[9·73] 20	[52] 20	92
4362	9	[66] 12	10	[71·6] 10	15	[7·53] 16	[illegible] [illegible]	91
4355	7	[66¼] 13	10	[73·0] 10	14	[8·9[illegible]] 1[illegible]	[48] 18	91

Awards.

Class 761.— Macaroni Wheat.	First Prize, No. 4338, Indian Runner, W. Clark, Angle Vale, South Australia. Second Prize, No. 4340, Macaroni, W. G. Reinhard, Wellington, New South Wales.
Class 762.— Hard or Strong Flour.	First Prize, No. 4346, Manitoba, A. Thibault, Tamworth. Second Prize, No. 4365, ,, Russell Brothers, Grenfell.
Class 763.— Medium Hard.	First Prize, No. 4353, Bobs, W. H. Thibault, West Tamworth. Second Prize, No. 4351, Bobs, W. G. Reinhard, Wellington.
Class 764.— Soft or Weak Flour.	First Prize, No. 4354, Petatz Surprise, W. Clark, South Australia. Second Prize, No. 4364, Cumberland, Frank Ridd, Winton.

Champion Prize, No. 4353, Bobs, W. H. Thibault, West Tamworth.

Special Prize for the best collection of five Farrer Wheats, No. 4368, Frank Ridd, Winton.

Special Prize for the best collection of five Wheats other than Farrer, No. 4369, Seth Forge.

The following information regarding the prize-winning wheats will be of interest to exhibitors and others :—

Class 761.—Macaroni—

First Prize, No. 4338, W. Clark, Angle Vale, South Australia ; variety, Indian Runner ; grown on sandy soil at Angle Vale ; sown at the rate of 1 bushel to the acre ; yield, 10 bushels per acre.

Second Prize, No. 4340, W. G. Reinhard, Wellington, New South Wales ; variety, Macaroni ; grown on red soil, at Oddfield, near Wellington ; sown ¾ bushel per acre ; yield, 10 bushels. Rainfall during growth, 12½ inches.

Class 762.—Hard Wheat—

First Prize, No. 4346, A. Thibault, Tamworth, New South Wales ; variety, Manitoba ; sown at Calala, Peel River Estate, on red soil ; sown at rate of ¾ bushel per acre ; yield, 24 bushels per acre. Rainfall, 11 inches.

Second Prize, No. 4365, Russell Brothers, Grenfell, New South Wales ; variety, Manitoba ; grown at Currawong, near Grenfell.

Class 763.—Medium Hard Wheat—

First Prize (and Champion Prize for best bag of wheat exhibited), No. 4353, W. H. Thibault, West Tamworth, New South Wales ; variety, Bobs ; grown on Phillip section of the Peel River Estate, on chocolate soil ; sown at rate of ¾ bushel per acre ; average yield, 24 bushels per acre. Rainfall during growth of crop, 11½ inches.

Second Prize, No. 4351, W. G. Reinhard, Wellington, New South Wales ; variety, Bobs ; grown at Oddfield, near Wellington, on gravelly soil ; sown ½ bushel per acre ; yield, 12 bushels. Rainfall, 12½ inches.

Class 764.—Soft Wheat—

First Prize, No. 4354, W. Clark, Angle Vale, South Australia ; variety, Petatz Surprise ; grown at Angle Vale, on sandy soil ; sown at rate of 1 bushel per acre ; yield, 12 bushels.

Second Prize, No. 4364, Frank Ridd, Winton ; variety, Cumberland ; grown at Winton, 12 miles from Tamworth, on strong red soil ; sown ¾ bushel per acre ; yield (average) 25 bushels per acre. Rainfall, about 13½ inches.

Special Prize for the best collection of five Farrer wheats.—No. 4368, grown by Frank Ridd, at Winton, near Tamworth, New South Wales ; grown on strong black and red soil ; sown ¾ bushels per acre ; yield (average), 25 bushels. Rainfall during growth, about 13½ inches. Varieties represented—Bobs, Cumberland, Federation, Plover, Comeback.

Special Prize for the best collection of five wheats other than Farrer.—No. 4369; Seth Forge, Oxley, *viâ* Tamworth, New South Wales; grown on Oxley section of Peel River Company's Estate, 4 miles from Tamworth, on soil varying from light-red to heavy black; sown at rate of ¾ bushels per acre; yield varying from 16 bushels in the case of Manitoba to 25 bushels in the case of Purple Straw. Rainfall, 12 to 13 inches. Varieties represented—Purple Straw, Steinwedel, Dart's Imperial, White Tuscan, Manitoba.

As already remarked, the exhibits show a distinct improvement over those of previous years in the matter of milling excellence, and this improvement undoubtedly coincides with a general improvement noticeable year by year in the wheat grown in the State. This applies more particularly to the hard and medium-hard wheats, the flours of which are both stronger, richer in gluten, and of better colour than in former years. The champion prize for the best bag of wheat exhibited was annexed, as in 1908, by a sample of Bobs, grown by Mr. W. H. Thibault, at Tamworth, which yields 24 bushels to the acre, with a bushel weight of 65¾ lb. The Farrer wheats have also done well in the soft-wheat class; but the first prize in this class is taken by a South Australian exhibitor, with a sample of Petatz Surprise, a wheat which is not very extensively grown locally, but which, I have been informed by Professor Angus, of South Australia, is a constant prize-winner in that State. This sample was the heaviest wheat exhibited, having the very respectable weight of 67½ lb. per bushel.

The macaroni wheats were hardly up to the standard of former years, either in number or quality; the prize in this class being also taken by South Australia with Indian Runner, a variety which mills fairly well for a grain of this type.

The prizes for the best collections of five wheats did not attract many competitors; but it is to be hoped that this class will be more patronised next year.

The most satisfactory point of this year's show is the indication that it gives of the increasing popularity of the strong-flour wheats, and the convincing proof afforded of the suitability of this type of grain (which is of the highest market value) to so extensive an area of the State; and in this connection it is extremely satisfactory to note the prominent position of the crosses which we owe to the late Mr. Farrer, and which are effecting a comparatively rapid revolution in the nature of our local wheat crop.

Farmers' Bulletins.

Bulletin No. 16, dealing with Manures and Manuring, and Bulletin No. 17, giving full particulars concerning the Analyses and Application of Fertilisers to all kinds of crops, are now ready, and may be had, free, on application to the Under Secretary, Department of Agriculture.

Farmers' Experiments at Tenterfield.

SOME OF THE RESULTS.

GEORGE VALDER, Chief Inspector.

IN view of the smallness of the areas available for experiments, and the great variation in soils over even a short distance, it was decided to conduct three experiments in different parts of this district, one at Homestead with oats and potatoes; another at Sunnyside with wheats; and the third at Bungulla with oats.

Experiments at Homestead.

The experiments at Homestead were carried out by Mr. G. F. Chick. The first experiment was a trial of four varieties of oats, viz., Algerian, Abundance, Potato, and White Tartarian. Owing to the dry season experienced the previous year, good seed oats of most varieties were exceedingly scarce, and, therefore, the trial had to be restricted to these four kinds. Half-acre plots of each of these were sown side by side in strips of ½ a chain by 10 chains. A second experiment consisted of 2 acre blocks, one sown with White Tartarian oats at the rate of 1½ bushels of seed to the acre, the other with White Tartarian oats and field peas mixed, 1 bushel of the oats being mixed with ½ bushel grey field peas.

The Object of Experiment with Oats and Peas.

The object of this experiment was to demonstrate that the mixture would give a greater yield, and that it would have a greater feeding value.

The soil at Mr. Chick's farm is a decomposed granite, which had been well worked, and was in good condition at the time of sowing. It had previously been cropped with maize.

Superphosphate was applied to all the plots at the rate of 56 lb. per acre.

Results of Experiment No. 1.

Sowing took place on the 26th June, and the crops were cut for green fodder on the 26th November, with the following results:—

	Tons	cwt.	qrs.
Potato...	6	10	2
Abundance	6	8	3
White Tartarian	5	15	1
Algerian	4	9	1

Potato gave the best result; but it was generally considered that for all-round points Abundance was superior to it, and that this variety would prove a very useful one for the Tenterfield district.

Most Suitable Variety for Cool Districts.

In most districts of this State the cultivation of oats is gradually being restricted to one variety, Algerian, the reason for this being that in the warm dry districts it, as a rule, gives better results than any other variety yet tried; and for the coastal districts where rust is prevalent, Algerian has

proved a better rust-resister than any other. The same result has been obtained in South Africa. Rust is very prevalent there, and, so far, Algerian is the only oat that has proved to be sufficiently rust-resistant to be successfully grown there. As a result, to-day, scarcely any other oat is grown, and, in fact, in Cape Colony there is no inquiry for any other seed oat but Algerian.

In the cooler districts, on the other hand, Algerian is not considered to be equal to several other varieties, and in this experiment it came last of the four varieties tried. It has also been proved of late that even Algerian is becoming very subject to rust when grown in our coastal districts, and, therefore, it will be necessary to try and find varieties more resistant to rust.

Breeding New Varieties.

At the Experiment Farms large numbers of varieties of oats are being tried, and it is hoped that some will be found which will give better results than the older varieties. It is also intended to shortly make a start with breeding new varieties of oats, this being a work that is very necessary, and which will, no doubt, give just as good results as have been obtained with the locally-bred wheats.

Trial of Oats sown alone and sown with peas.

The trial of oats *v.* oats and peas resulted as follows:—

	Tons	cwt.	qrs.
1 acre Tartarian Oats	6	10	2
1 ,, ,, and Peas ...	7	16	0

This yield of over 1 ton more from the mixture of oats and peas speaks highly for the value of this combination. Besides this, it was found that the mixture was superior in feeding value to the oats alone, and it may be concluded that the mixture takes less out of the soil. I cannot impress too strongly upon farmers the advantage of making a combination of this kind when sowing fodder crops.

Experiments at Bungulla.

Similar trials to the above were put in on Mr. H. H. Willgoose's farm at Bungulla, but owing to the soil not being in good condition at the time of sowing the growth was slow, and the result was not considered satisfactory as a test. The crop was cut for hay, and the Potato variety again gave the highest yield. As stated, however, the trial was not considered a reliable one.

Experiments at Sunnyside.

A plot of 2 acres was selected upon Mr. Thos. Roos' farm, and this was sown with four varieties of wheat, which gave the following yields:—

	Grain per acre.	Hay per acre.		
	Bushels.	Tons	cwt.	qrs.
Tarragon	23	1	13	0
Power's Fife...	19	1	6	3
Comeback	16	0	18	3
Rymer	14	1	4	1

From this it will be seen that Tarragon was easily first, both for hay and grain. Mr. Roos reported that he considered it to be an excellent variety for cultivation in this district.

Results of experiments with potatoes will be published later.

Progress Report on Experiments with Fertilisers for Wheat for Hay

AT HAWKESBURY AGRICULTURAL COLLEGE AND EXPERIMENT FARM, RICHMOND.

A. H. E. McDONALD, Experimentalist.

THE object of these experiments is to ascertain :—

1. The effect of a manure which supplies only one ingredient of plant-food.
2. The effect following the application of a manure containing two of the ingredients.
3. The effect of a manure supplying the three essential ingredients.
4. The best time at which to apply the manure.

The manures used in the experiment were superphosphate and Thomas' phosphate, which supply phosphoric acid ; sulphate of potash, which supplies potash ; and sulphate of ammonia and nitrate of soda, which supply nitrogen.

These experiments have been arranged in such a way that the same manure will be applied to the same land year after year. A system of crop rotation has been arranged so that the land will not be readily exhausted by the continuous growth of one crop, and so that the effect of the manures may be observed upon different crops. By adopting this method the relation between the manures and the soil, and between the manures and the different crops will be ascertained.

Preparation of the Soil and Sowing.

The area for the experiment was about 1 acre. The soil was medium red loam, easy to work, fairly fertile, and possessing good powers of absorbing and retaining moisture. It was previously cropped with potatoes. In February it was ploughed about 7 inches deep. Shortly after ploughing a very good fall of rain occurred, and it was harrowed down into a fine condition immediately it was firm enough to carry the teams. It was harrowed at intervals until May, when it was ploughed about 4 inches deep and harrowed to prepare for sowing.

The manuring of the different plots was done before sowing except in case of plots 11 and 12 (see table).

Wheat of Thew variety was drilled in at the rate of 1 bushel per acre on 19th May, and the land immediately harrowed. The seed germinated quickly, and an even growth resulted. The manure was carefully broadcasted by hand on the centre 9 feet of each plot, which was 13 feet in width.

To prevent the manure from one plot affecting the yield of an adjacent plot, an area was harvested in the centre of each plot. This was one-fiftieth of an acre, and was 6 feet wide and 145 feet long. A series of unmanured

CHART 1,

Showing Increase or Decrease of Crop following use of certain Manures.

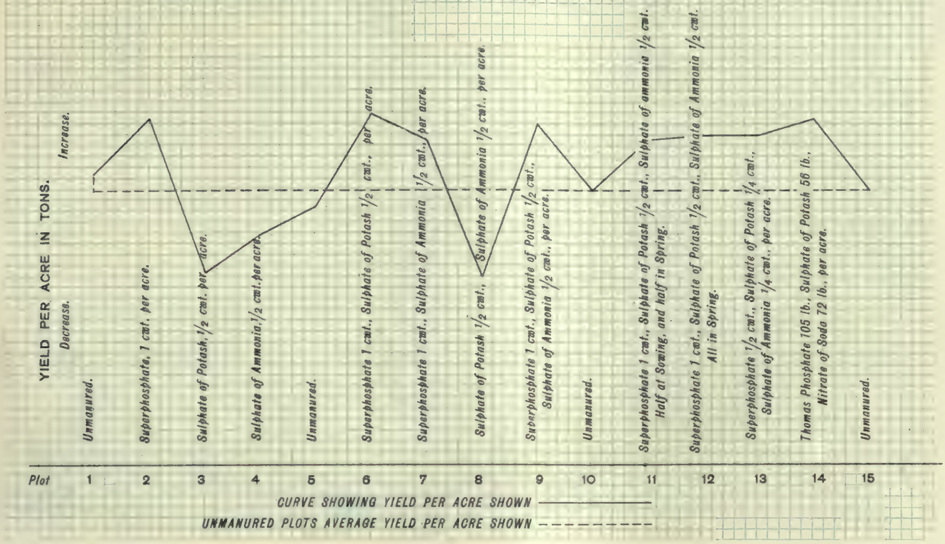
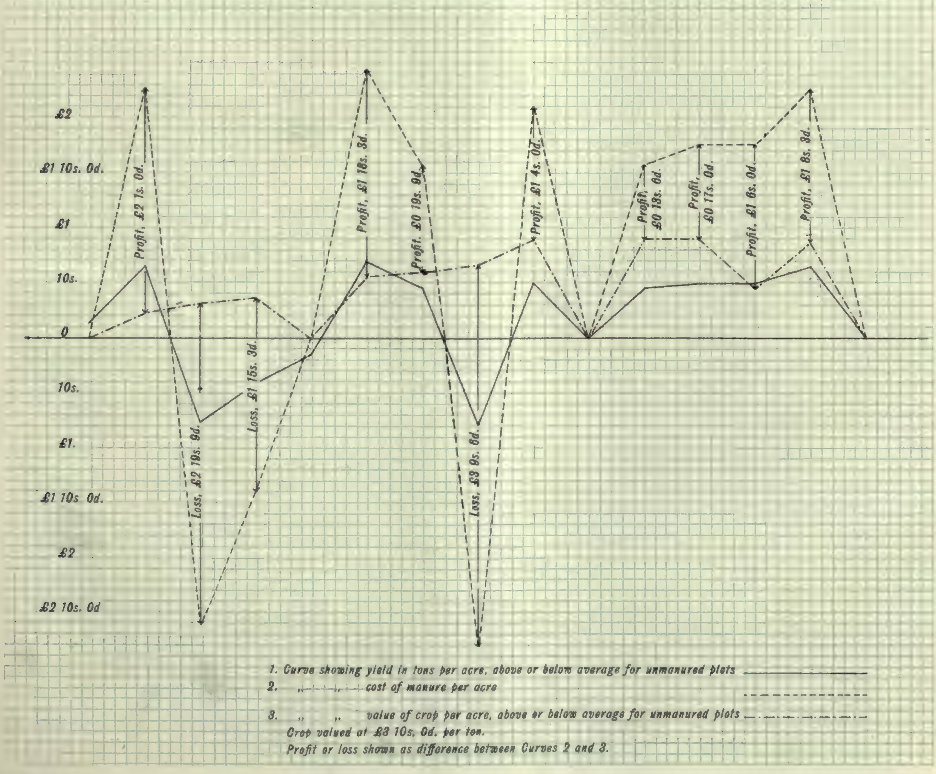


CHART 2.



plots were left at regular intervals so that the results from the manured plots could be compared with the average result of the unmanured plots.

The following rainfall was recorded from the time of sowing till harvesting :—

May	·38 inches	August ...	4·75 inches
June	·05 ,,	September	·57 ,,
July	1·83 ,,	October ...	·37 ,,
Total			7·95 inches

The rainfall for the four months preceding sowing was :—

January ...	1·09 inches	March ...	1·68 inches
February ...	9·70 ,,	April ...	1·37 ,,

Results of Experiments.

The results of the experiments are given in the following table :—

RESULTS of experiments with fertilisers for wheat.

Variety, Thew ; sown 19 May ; harvested as hay, 19 October, 1908.

No. of Plot.	Kind of Manure.	Quantity per plot (area, 1/50 acre.)	Quantity per acre.	Yield per plot (area, 1/50 acre).	Yield per acre.	Increase per acre.*	Decrease per acre.*	Cost of manure per acre.	Profit per acre.
		lb. oz.	cwt.	lb.	T. cwt.	cwt.	cwt.	s. d.	£ s. d.
1	Unmanured	..	...	118	2 13	...	...	...	......
2	Superphosphate	3 12	1	141	3 3	13	...	4 6	2 1 0
3	Sulphate of potash ...	1 14	0½	78	1 15	...	15	6 3	......
4	Sulphate of ammonia ...	1 14	0½	94	2 2	...	8	7 3	......
5	Unmanured	...	...	105	2 7	...	...	...	......
6	Superphosphate ... ... Sulphate of potash ...	3 12 1 14	1 0½	143	3 4	14	...	10 9	1 18 3
7	Superphosphate ... ... Sulphate of ammonia ...	3 12 1 14	1 0½	132	2 19	9	...	11 9	0 19 9
8	Sulphate of potash ... Sulphate of ammonia ...	1 14 1 14	0½ 0½	76	1 14	...	16	13 6	......
9	Superphosphate ... ... Sulphate of potash ... Sulphate of ammonia ...	3 12 1 14 1 14	1 0½ 0½	139	3 2	12	...	18 0	1 4 0
10	Unmanured	...	...	112	2 10	...	...	...	......
11	Superphosphate ... ... Sulphate of potash ... Sulphate of ammonia . (Half applied at sowing and half in spring).	3 12 1 14 1 14	1 0½ 0½	132	2 19	9	...	18 0	0 13 6
12	Superphosphate ... ... Sulphate of potash .. Sulphate of ammonia ... (All applied in spring)	3 12 1 14 1 14	1 0½ 0½	134	3 0	10	...	18 0	0 17 0
13	Superphosphate ... ... Sulphate of potash ... Sulphate of ammonia ...	1 14 0 15 0 15	0½ 0¼ 0¼	134	3 0	10	...	9 0	1 6 0
			lb.						
14	Thomas' phosphate ... Sulphate of potash ... Nitrate of soda	3 8 1 14 2 6	105 56 72	141	3 3	13	...	17 3	1 8 3
15	Unmanured	...	...	112	2 10	..	...	...	......

* Increases and decreases have been taken from the average of the unmanured plots = 2 tons 10 cwt. per acre. Hay valued at £3 10s. per ton. Two additional plots, to ascertain the best time to apply the manures were included in the experiment, but were not developed during the season under review.

A marked feature of the results is the uniform increases in the yields from those plots which received superphosphate, either alone or in combination with other manures. The fact that the yield of hay from the plot which received superphosphate alone was only 1 cwt. per acre less than the highest yield in the series, seems to indicate that, practically, the only ingredient which is not present in sufficient available quantities is phosphoric acid. This is also borne out by the results from those plots which received sulphate of potash and sulphate of ammonia, either alone or together. The failure of sulphate of potash and sulphate of ammonia to produce increased yields is a point which requires further investigation.

No Manure. Superphosphate.

Experiments with Fertilisers—Hawkesbury Agricultural College.

It would seem from the experiment, at this stage of its progress, therefore, that it is only necessary to apply to this particular area phosphoric acid in some form to secure satisfactory results.

Thomas' phosphate was substituted for superphosphate on one plot, with good results, the yield being slightly better than that from the plot receiving the same amount of actual plant-food, but with the phosphoric acid in the form of superphosphate.

When to apply Manure.

The results from the application of a complete manure at different periods seem to indicate that the best time to apply the manure is when sowing the seed. One plot was manured when the seed was sown; another received half the manure with the seed, and the remainder in spring; and to

another, the whole of the manure was applied in spring, just before the crop commenced to shoot upwards. The plot which received the whole of the manure with the seed gave 2 cwt. of hay per acre more that the one which received all the manure in the spring, and 3 cwt. more than the one which received half at sowing and half in spring. From observations made during the growth of the crop, it is highly probable that the chief influence which the manure had upon the crop was in assisting it whilst young. The plots supplied with phosphoric acid were remarkably noticeable through the greater stooling of the plants, their rapid growth, and the healthy dark green colour of the foliage. The difference in these plots could be noticed throughout, and the wheat on them came into head about three days before those not treated. Two of the plots in the experiment were not developed during the past season.

Superphosphate and Sulphate of Potash. Sulphate of Potash and Sulphate of Ammonia.

Experiments with Fertilisers—Hawkesbury Agricultural College.

Comparative Profit.

The greatest profit resulted from the use of superphosphate alone. An expenditure of 4s. 6d. per acre resulted in an increase over the average of 13 cwt. of hay per acre worth, at £3 10s. per ton, £2 5s. 6d., leaving a profit due to the use of manure of £2 1s. The use of sulphate of potash and sulphate of ammonia resulted in a loss, but it has not been stated since it is possible that these manures may prove beneficial to future crops, and this point has yet to be determined. Portion of the experiment area has been laid off to ascertain the influence of manures upon succeeding crops. A rotation of maize, potatoes, and wheat has been adopted in which different manures are applied to the potatoes, but the wheat and maize are grown without manurial treatment. It is hoped by this, in the course of a few years, to arrive at definite conclusions as to the lasting effects of manures. Details of this experiment will be published later when the returns become available.

The Importance of Good Cultivation.

Whilst judicious manuring has been shown by the results to have a very favourable influence upon the yields, the advantage of thorough cultivation of the soil must not be overlooked. It was the attention to this detail which was largely responsible for these results.

One of the first essentials to success is a plentiful supply of moisture, and it is often the lack of this which leads to failures in crop production. No matter how rich a soil is, if moisture is deficient it fails to produce good yields. This is a well-known maxim, yet one which unfortunately is overlooked frequently. Manures are useful on all soils, but they only afford assistance and cannot take the place of good cultivation. The soil must be thoroughly prepared in such a way that the roots will have abundant room in which to develop, and so that the necessary moisture can be conserved for the use of the crop. The good effects of having the soil in proper condition to receive the seed is evidenced by the results of these experiments. To show clearly the benefit which resulted from proper cultivation, the rainfall for the four months previous to sowing has been given in the rainfall table. It was undoubtedly the conservation of much of this moisture in the soil which was responsible for the high yields obtained, since the low rainfall of about 8 inches recorded during the growth of the crops was barely sufficient for their needs. If the cultivation of the soil had been neglected until just before sowing, the soil would have been quite dry, and the seed would have germinated badly. By early deep ploughing, however, and the subsequent use of the harrow the soil was maintained in a moist friable condition, favourable to complete germination of the seed and a vigorous growth of the young plants. The crops did not make a great deal of top growth during June and July, but the roots were extending down into the soil, and when the rain of August came the crops were in a condition to take full benefit from the moisture and consequently made a rapid strong growth.

Fowl Cholera and the Common Fowl-tick.

Col. Pease, Inspector-General of the Indian Civil Veterinary Department, records a discovery of much importance to poultry-keepers. The greatest scourge of poultry in India is a disease known as "fowl cholera." Conductor Dare, at Mian Mir, has now ascertained that the disease is really due to a specific organism of the spirochætes type. It is spread by the agency of the common fowl-tick (*Argas persicus*), which lives in crevices and crannies of the roosting place during the day and attacks the poultry at night.* The tick is difficult to destroy, the method adopted in the western districts of New South Wales (where, in some seasons, it is very prevalent) being to paint the fowl-house and surroundings with hot coal tar. Now that the fatal "cholera" has been traced to this parasite, a suitable form of treatment will, doubtless, soon be discovered.

* *Nature.*

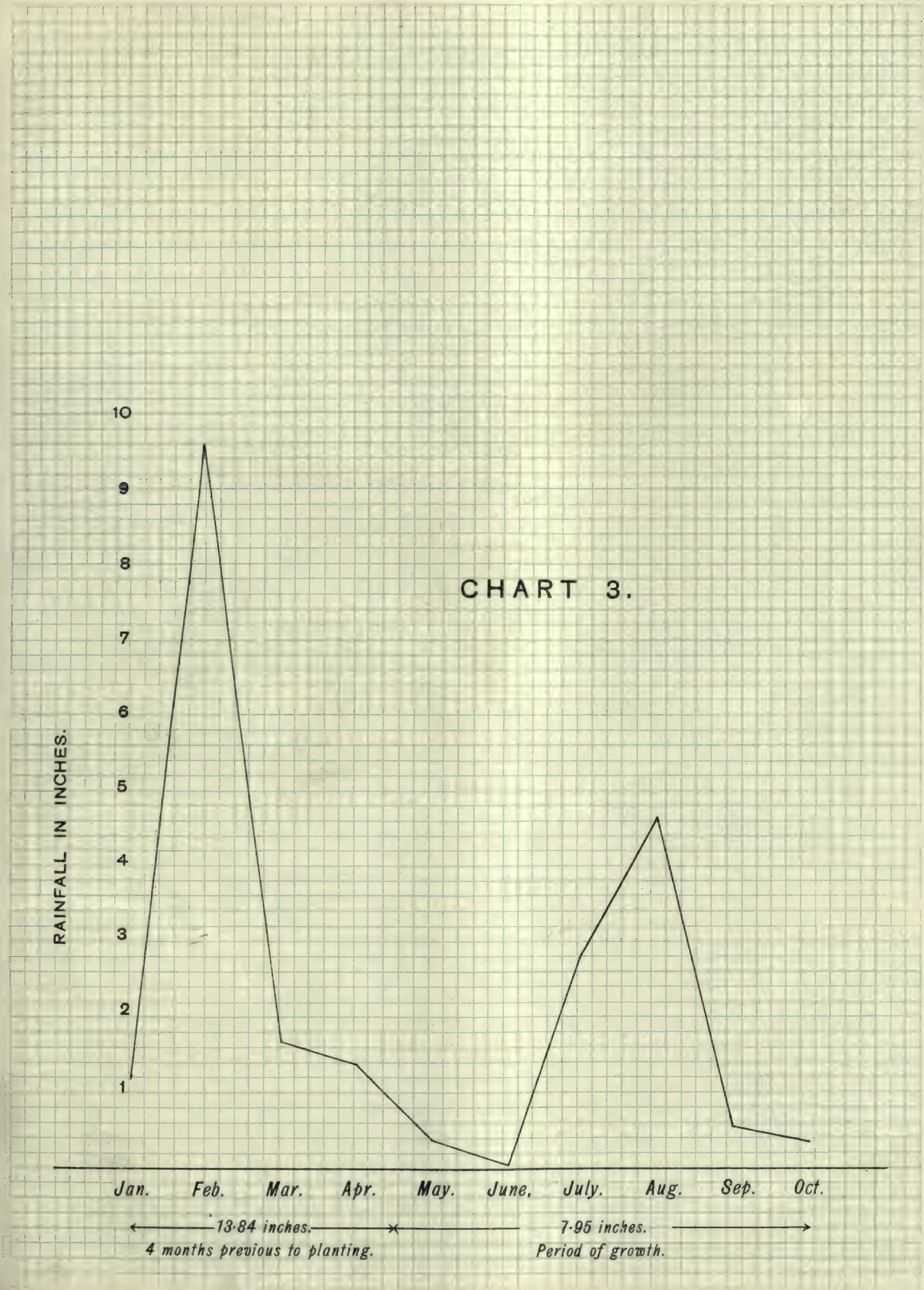


CHART 3.
RAINFALL IN INCHES.
10
9
8
7
6
5
4
3
2
1
Jan.
Feb.
Mar.
Apr.
May.
June.
July.
Aug.
Sep.
Oct.
13·84 inches.
4 months previous to planting.
7·95 inches.
Period of growth.

Field Experiments at Bathurst Experiment Farm, 1908.

R. W. PEACOCK, Manager.

THE purpose of the experiments was to obtain data as to the comparative effects of various methods of sowing, treatment, and harvesting of wheat on land which had been subjected previously to varied treatment as regards

Cultivation Paddocks, Bathurst Experiment Farm.

crops and manures. The experiments were carried out in different paddocks of the farm, which for convenience of reference are known by their respective numbers.

The areas under different varieties in No. 2 paddock were divided into two parts, 1 and 2. This was done in order to have correct comparisons, as in part 2 the soil was too variable. The wheats in part 1 are comparable.

Paddock No. 20 was divided into two parts so as to take as many varieties as possible, without the plots being too narrow. No. 1 was upon better soil than No. 2. These varieties should be compared with yields of Cleveland as they appear in each division.

Cleveland wheat was chosen as the standard variety, and should be compared in judging the results of the various treatments throughout the paddocks.

WHEATS grown at Bathurst Experiment Farm, 1908.

Variety.	Previous Crop.	No. of Paddock.	Area.	Date sown.	Seed sown per acre.	Manure per acre.	Date harvested.	Yield per acre.		Remarks.
			acres.		lb.			bus.	lb.	
Cleveland 1 ..	Scarlet clover ..	2	0·73	28 Apl.	28	1 cwt. superphosphate	16 Dec.	37	40	
Cleveland 1 ..	,, ..	2	0·16	28 ,,	28	Nil.	16 ,,	26	58	
Cleveland 2 ..	,, ..	2	1·5	28 ,,	28	1 cwt. super.	16 ,,	29	58	
Cleveland 2 ..	,, ..	2	·319	28 ,,	28	Nil.	16 ,,	25	1	
Cleveland	Fallow	2	2·496	30 May	35½	Various ..	23 ,,	11	59	Manure experiment.
Rymer 1, Bathurst	Maize	2	0·945	4 ,,	33½	1 cwt. super.	17 ,,	11	38	
Cleveland 1 ..	Wheat	2	2·035	28 Apl.	28	,,	16 ,,	10	39	Seed treatment experiment.
Rymer 1, Wagga ..	Maize	2	0·925	4 May	33½	,,	17 ,,	10	13	
Sussex 1	,, ...	2	0·368	5 ,,	29	,,	17 ,,	10	3	
Russo-Barletta 1 ..	,, ...	2	0·368	5 ,,	27½	,,	24 ,,	9	38	
Tarragon 1 ..	,, ...	2	1·306	5 ,,	34½	,,	17 ,,	9	25	Average yield of paddock, 10 bushels 7 lb.
Power's Fife 1 ..	,, ...	2	0·375	5 ,,	27½	,,	24 ,,	7	25	
Rymer 2	,, ...	2	3·225	4 ,,	33½	,,	22 ,,	7	20	
Russo-Barletta 2 ..	,, ...	2	0·63	5 ,,	27½	,,	24 ,,	6	52	
Cleveland 1 ..	,, ...	2	0·828	27 Apl.	23	,,	16 ,,	6	45	
Tarragon 2 ..	,, ...	2	3·029	5 May	34½	,,	23 ,,	6	24	
Cleveland 2 ..	Wheat and maize	2	5·513	28 Apl.	28	,,	22 ,,	6	12	
Sussex 2	Maize	2	0·631	5 May	29	,,	23 ,,	6	2	
Power's Fife 2 ..	,, ...	2	0·643	5 ,,	27½	,,	24 ,,	4	46	
Federation 1 ..	,, ...	2	0·444	4 ,,	34	,,	17 ,,	4	43	
Cleveland 1 ..	Wheat	2	0·182	28 Apl.	28	Nil.	16 ,,	3	56	
Federation 2 ..	Maize	2	0·764	4 May	34	1 cwt. super.	23 ,,	3	25	
Cleveland 1 ..	,, ...	2	0·187	27 Apl.	28	Nil.	16 ,,	3	23	

Cleveland Wheat, 1908, after bare fallow.

WHEATS grown at Bathurst Experiment Farm, 1908—*continued.*

Variety.	Previous Crop.	No. of Paddock.	Area.	Date sown.	Seed sown per acre.	Manure per acre.	Date harvested.	Yield per acre.		Remarks.
			acres.		lb.			bus.	lb.	
Federation	Scarlet clover	1A	2·31	13 May	33	Nil.	18 Dec.	8	6	Seed treatment experiment. Average yield of paddock, 7 bushels 21 lb.
Comeback	,,	1A	1·04	15 ,,	33½	Nil.	15 ,,	5	51	
Bobs	Wheat	5	5·0	22 May	29½	Various	21 Dec.	6	32	Manure experiment. Yield of paddock, 6 bushels 32 lb. per acre.
Cleveland	Rape	2A	2·878	27 Apl.	26½	Nil.	21 Dec.	15	54	Average yield of paddock, 13 bushels 11 lb. per acre.
Jonathan	,,	2A	1·91	29 ,,	29½	Nil.	18 ,,	9	5	
Cleveland	Fallow	19	0·677	16 May	28	1 cwt. super.	17 Dec.	17	27	*Thick and thin seeding experiment. Average yield of paddock, 17 bushels 5 lb. per acre.
Cleveland	,,	19	1·105	16 ,,	*	,,	17 ,,	17	23	
Cleveland	,,	19	0·107	16 ,,	28	Nil.	17 ,,	11	40	
Bobs	Maize	26	1·708	27 May	31	1 cwt. super.	14 Dec.	7	20	Seed treatment experiment. Average yield of paddock, 6 bushels 13 lb. per acre.
Jumbuck	,,	26	2·157	27 ,,	35	,,	14 ,,	7	8	
Bobs	,,	26	2·261	27 ,,	33½	,,	14 ,,	6	46	
John Brown	,,	26	1·936	28 ,,	31	,,	14 ,,	6	18	
Cleveland	,,	26	1·786	28 ,,	38½	,,	14 ,,	5	47	
Comeback	,,	26	1·914	26 ,,	32	,,	14 ,,	3	50	
Cretan	Maize	18	1·627	29 May	33	1 cwt. super.	21 Dec.	5	1	Average yield of paddock, 4 bushels 19 lb. per acre.
Cleveland	,,	18	4·529	19 ,,	32	,,	22 ,,	4	59	
Saragolla	,,	18	0·41	29 ,,	31½	,,	21 ,,	4	20	
Comeback	,,	18	1·00	20 ,,	33	,,	18 ,,	4	6	
Federation	,,	18	3·076	20 ,,	32	,,	17 ,,	3	33	
Firbank	,,	18	0·99	20 ,,	30	,,	18 ,,	3	14	
Portion 1—										Average yield of paddock, 8 bushels 59 lb. per acre.
Cleveland	Rape	20	0·918	9 May	31½	Nil.	15 Dec.	16	36	
Genoa	,,	20	1·07	11 ,,	25	,,	10 ,,	14	54	
Mudgee	,,	20	0·469	11 ,,	29½	,,	10 ,,	13	2	
White Loaf	,,	20	1·058	11 ,,	28	,,	10 ,,	12	39	
Uppercut	,,	20	1·044	11 ,,	28½	,,	9 ,,	11	44	
Early Jonathan	,,	20	·434	11 ,,	30½	,,	10 ,,	8	45	
Florence	,,	20	1·03	11 ,,	29	,,	9 ,,	7	14	
Bunyip	,,	20	2·08	13 ,,	27	,,	10 ,,	7	10	
Portion 2—										
Australian Lammas.	Rape	20	1·042	11 May	29½	Nil.	15 Dec.	11	39	
Cleveland	,,	20	1·13	9 ,,	31½	,,	15 ,,	10	46	
Warren	,,	20	1·034	12 ,,	27	,,	9 ,,	7	46	
Dexter	,,	20	1·042	12 ,,	27½	,,	10 ,,	5	33	
Thew	,,	20	4·422	12 ,,	26½	,,	9 ,,	5	8	

Buffers for sparrows, 13·579 acres, averaged 4 bushels 59 lb. per acre. Average yield per acre, exclusive of buffers for sparrows, = 8 bushels 32 lb. Highest yield 37 bushels 40 lb. per acre.

Manured. Unmanured.

Cleveland Wheat, 1908, after Clover.

Rotation Experiment.

Variety.	Previous Crop.	No. of Paddock.	Area.	Date sown.	Seed per acre.	Manure per acre.	Date harvested.	Yield per acre.		Remarks.
			acres.		lb.	Superphosphate.		bus.	lb.	
Cleveland	Scarlet clover ..	2	·73	28 Apr.	28	1 cwt. ..	16 Dec.	37	40	Strictly comparable.
,, ...	Wheat	2	·846	28 ,,	28	,, ..	16 ,,	9	41	
,, ...	Maize	2	·828	27 ,,	28	,, ..	16 ,,	6	45	
,, ...	Rape	2A	2·878	27 ,,	26½	Nil.	21 ,,	15	54	These, on account of being in different paddocks, are not strictly comparable.
,, ...	Maize	26	1·786	28 May	38½	1 cwt. super.	14 ,,	5	47	
,, ...	Maize	18	4·529	19 ,,	32	,, ..	22 ,,	4	59	
,, ...	Fallow	19	·677	16 ,,	28	,, ..	17 ,,	17	27	
,, (portion 1)	Rape	20	·918	9 ,,	31½	Nil.	15 ,,	16	36	
,, (portion 2)	Rape	20	1·13	9 ,,	31½	,, ...	15 ,,	10	46	

Note.—The low yields after maize are due to the fact that the maize crop had pumped the soil dry as regards moisture, and the showery nature of the subsequent falls prevented profitable yields. By referring to last year's results, it will be noticed that wheat after maize gave the highest yields. All the paddocks which had been ploughed prior to the good fall on the last day of January, viz., 247 points, gave reasonable yields. The crops after scarlet clover, rape, and bare fallow, had the advantage of this fall. The above is interesting as a guide to the powers of the showery rainfall which fell throughout the growth of the wheat crops, where no reserves of soil moisture were carried over by a summer fallow.

Variety Tests.

The yields of different varieties are only comparable when the preceding crop is taken into consideration. Cleveland has been used in each paddock as a standard, and each variety should be compared with Cleveland in the same paddock.

Variety.	No. of Paddock.	Area.	Previous Crop.	Yield per acre.		Remarks.
		acres.		bus.	lb.	
Cleveland	2	·828	Maize	6	45	The good rainfalls of the 22nd and 23rd of November, benefited the later maturing wheats. The early wheat, Federation, was too forward to receive a proportional benefit.
Rymer	2	1·869	,, ...	10	56	
Federation	2	·444	,, ...	4	43	
Sussex	2	·368	,, ...	10	3	
Power's Fife.. ..	2	·375	,, ...	7	25	
Russo-Barletta ..	2	·368	,, ...	9	38	
Tarragon	2	1·306	,, ...	9	25	

Harvesting Cleveland Wheat Experiment.—Yield 37 bush. 40 lb. per acre.

Variety Tests—*continued.*

Variety.	No. of Paddock.	Area.	Previous Crop.	Yield per acre.		Remarks.
		acres.		bus.	lb.	
Cleveland	2A	2·878	Rape	15	54	Strictly comparable.
Jonathan	2A	1·91	,,	9	5	
Federation	1A	2·31	Scarlet clover	8	6	Comparable.
Comeback	1A	·26	,,	6	9	
Cleveland	26	1·786	Maize	5	47	Cleveland and John Brown are comparable with each other. Bobs, Comeback, and Jumbuck may be compared with each other.
Bobs	26	2·261	,,	6	46	
Jumbuck	26	2·157	,,	7	8	
John Brown	26	1·936	,,	6	18	
Comeback	26	1·914	,,	3	50	
Cleveland	18	4·529	Maize	4	59	On account of Federation being so short, a fair amount was lost whilst harvesting with binder, and with Comeback it was not benefited proportionately by late rains.
Cretan	18	1·627	,,	5	1	
Saragolla	18	·41	,,	4	20	
Comeback	18	1·00	,,	4	6	
Federation	18	3·076	,,	3	23	
Firbank	18	·99	,,	3	14	
Cleveland	20 (Part 1)	·918	Rape	16	36	These being much of the same season, as regards maturity, are comparable.
Genoa	,,	1·07	,,	14	54	
Mudgee	,,	·469	,,	13	2	
White Loaf	,,	1·058	,,	12	39	Comparable.
Uppercut	,,	1·044	,,	11	44	
Early Jonathan	,,	·434	,,	8	45	Early Jonathan and Bunyip were the earliest, and did no receive the same benefits from the late rains. Florence, as regards earliness, is midway between Bunyip and Uppercut.
Florence	,,	1·03	,,	7	14	
Bunyip	,,	2·08	,,	7	10	
Cleveland	20 (Part 2)	1·13	Rape	10	46	Comparable.
Australian Lammas	,,	1·042	,,	11	39	
Warren	,,	1·034	,,	7	46	Warren, as regards earliness, is of the same season a Florence.
Dexter	,,	1·042	,,	5	33	Comparable.
Thew	,,	4·227	,,	5	8	

Abundance Oats at Bathurst Farm, 1908, after rape.

YIELDS, if cut for Hay.

A small plot, selected as a fair average sample of the whole, was cut for hay, in order to test the yields of the various treatments from a hay-producing standpoint.

Variety.	Previous Crop.	Manuring per acre.	No. of Paddock.	Seed sown per acre.	Date sown.	Date Harvested.	Yield per acre.	Remarks.
				lb.			t. c. qr.	
Cleveland	Scarlet Clover ..	1 cwt. superphosphate.	2	28	28 Apl.	30 Nov.	2 10 2	To test result of manure.
,, ...	,, ..	Nil.	2	28	28 ,,	30 ,,	1 3 0	
,, ...	Rape	,,	2 A	26½	27 ,,	7 Dec.	1 1 1	
,, ...	Wheat	1 cwt. super.	2	28	28 ,,	30 Nov.	1 2 2	,, ,,
,, ...	,, ...	Nil.	2	28	28 ,,	30 ,,	0 8 2	
,, ...	Maize	1 cwt. super.	2	28	27 ,,	2 Dec.	0 11 1	,, ,,
,, ...	,, ...	Nil.	2	28	27 ,,	2 ,,	0 7 3	
,, ...	Fallow	1 cwt. super.	19	28	16 May	4 ,,	0 17 3	,, ,,
,, ...	,, ...	Nil.	19	28	16 ,,	11 ,,	0 10 0	
,, ...	,, ...	1 cwt. super.	19	130½	16 ,,	4 ,,	1 4 1	Thick and thin seeding experiment.
,, ...	,, ...	,,	19	69¼	16 ,,	4 ,,	1 4 1	
,, ...	,, ...	,,	19	34½	16 ,,	4 ,,	1 1 1	
,, ...	,, ...	,,	19	24	16 ,,	4 ,,	1 2 3	
,, ...	,, ...	,,	19	10½	16 ,,	4 ,,	0 19 1	

EXPERIMENTS for treatment of Bunt.

Areas under field conditions were sown with seed treated with different fungicides, to test their effects upon the yield.

No. 1.

Treatment.	Previous Crop.	Variety.	No. of Paddock.	Area.	Seed sown per acre.	Date sown.	Manure per acre.	Date Harvested.	Yield per acre.	Remarks.
				acres	lb.				b. lb.	
Formalin ..	Wheat ..	Cleveland	2	·397	32	29 Apl.	1 cwt. superphosphate.	16 Dec.	12 10	Average yield, 10 bushels 39 lb.
Bluestone and lime-water.	,, ..	,, ..	2	·389	32	29 ,,	,, ..	16 ,,	11 34	
Bluestone ..	,, ..	,, ..	2	·403	32	29 ,,	,, ..	16 ,,	10 17	
Hot water ..	,, ..	,, ..	2	·846	28	28 ,,	,, ..	16 ,,	9 41	

No. 2.

Treatment.	Previous Crop.	Variety.	No. of Paddock.	Area.	Seed sown per acre.	Date sown.	Manure per acre.	Date Harvested.	Yield per acre.	Remarks.
Bluestone and lime-water.	Scarlet Clover	Comeback	1A	·26	33	15 May	Nil.	15 Dec.	6 11	Average yield, 5 bushels 51 lb.
Bluestone ..	,, ..	,, ..	1A	·26	33	15 ,,	,,	15 ,,	6 9	
Formalin ..	,, ..	,, ..	1A	·26	33½	15 ,,	,,	15 ,,	6 9	
Hot water ..	,, ..	,, ..	1A	·26	34½	15 ,,	,,	15 ,,	4 17	

No. 3.

Treatment.	Previous Crop.	Variety.	No. of Paddock.	Area.	Seed sown per acre.	Date sown.	Manure per acre.	Date Harvested.	Yield per acre.	Remarks.
Hot water ..	Maize ..	Bobs ..	26	·427	33	27 May	1 cwt. superphosphate.	14 Dec.	8 4	Average yield, 7 bushels 20 lb.
Bluestone ..	,, ..	,, ..	26	·427	34	27 ,,	,, ..	14 ,,	7 34	
,, and lime-water.	,, ..	,, ..	26	·427	34	27 ,,	,, ..	14 ,,	7 13	
Formalin ..	,, ..	,, ..	26	·427	33	27 ,,	,, ..	14 ,,	6 31	

MEAN Yields of Nos. 1, 2, and 3.

	bus. lb.	
Bluestone and lime-water	8 32	Average yield, 8 bushels 2 lb.
Formalin	8 16	
Bluestone	8 0	
Hot water	7 20	

NOTE.—The differences of yield are so slight that the results cannot be considered as a guide. Factors over which it was impossible to have control may have had counteracting influences.

THICK and Thin Seeding Experiment.

Variety.	Previous treatment.	No. of Paddock.	Area	Quantity of seed sown per acre.	Date sown.	Manure per acre.	Date harvested.	Yield per acre.	Excess yield over amount of seed.	Remarks.
			acres	lb.				bu. lb.	bu. lb.	
Cleveland ..	Fallow ..	19	·221	130½	16 May	1 cwt. superphosphate.	17 Dec.	18 33	16 22½	Average yield, 17 bushels 23 lb.
,, ..	,, ..	19	·221	24	16 ,,	,, ,,	17 ,,	18 33	18 9	
,, ..	,, ..	19	·221	69½	16 ,,	,, ,,	17 ,,	17 47	16 37½	
,, ..	,, ..	19	·221	34½	16 ,,	,, ,,	17 ,,	17 20	16 45⅓	
,, ..	,, ..	19	·221	10½	16 ,,	,, ,,	17 ,,	14 42	14 31½	

RAINFALL and its Distribution for 1908.

January.		Feb.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		Dec.	
Date.	Points.	Date.	Points.	Date.	Points.	Date.	Points.	Date.	Points.	Date.	Points.	Date.	Points.	Date.	Points.	Date.	Points.	Date.	Points.	Date.	Points.	Date.	Points.
8	72	1	247	15	9	12	2	2	17	10	4	2	6	2	41	2	32	9	4	2	20	2	17
9	21	9	6	16	7	15	1	3	9	11	28	9	9	3	42	5	34	17	23	3	26	8	2
10	38	13	4	..	..	16	12	5	1	13	6½	17	8	11	4	6	33	18	28	4	3	12	23
23	6	18	1	..	..	18	50	6	17	14	1	19	3	12	18	7	15	20	3	8	4	13	1
26	30	19	16	..	..	..	..	7	1	19	21	21	28	16	1	12	15	..	..	22	68	22	40
27	42	20	10	..	..	..	..	12	8	20	15	28	17	17	8	13	31	..	..	23	39	..	..
30	50	24	8	..	..	..	..	14	36	22	4	29	24	22	1	14	1	..	..	27	10	..	..
..	..	..	..	..	..	..	..	15	16	23	14½	30	8	23	27	15	5	..	..	..	..	..	..
..	..	..	..	..	..	..	..	19	6	24	1	..	..	24	1	20	21	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21	6	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	28	1	..	..	..	..	..	..
259		292		16		65		111		95		103		143		194		58		170		83	

Total for year, 15·89 inches, distributed over 82 days.

During the first 31 days 506 points were registered.

The bulk of the rainfall was made up of showers, the best falls after that registered on the 1st February being upon the 22nd and 23rd November. This, coupled with the fact that the rainfalls for the previous six years were considerably below the average, resulted in a disastrous season, considered to be worse than the drought of 1902.

The rainfall of 1902 was but 14·83 inches; it was, however, preceded by a rainfall much above the average.

View of Bathurst Experiment Farm.

Trials of Methods of Soil Culture.

A paper read by Mr. R. W. Peacock, entitled "Australian Dry Farming—a new system of Soil Culture," at the Brisbane Meeting of the Australian Association for the Advancement of Science, has been the subject of much criticism by farmers and agricultural journals.

Mr. Peacock claims as his system, "the production of self-mulching surfaces," which lead to the deepening of the soil and free access of rains; prevent evaporation, surface rooting, germination of weed seeds, and erosion of undulating country, and tend to considerably increase the yields."

The cultural practice advocated is "to keep the dust at the bottom, the granules of soil next, then the crumbs and the clods on top."

The Minister of Agriculture states the methods advocated by Mr. Peacock as the result of observations extending over twelve years at Coolabah and Bathurst Experiment Farms cannot, of course, be regarded as constituting "a system of soil culture." Much of the matter can be approved by intelligent practical men, but it is not new; and what is new has yet to be proved. From the point of view of the Department of Agriculture it is definitely recognised that before the official imprimatur can be given to these particular views, or to any officer's theories not amply demonstrated, or before any method in connection with soil culture can be regarded as a "system," exact experimentation extending over a prolonged series of years, and throughout a comprehensive variety of soils and local conditions, must have been carried out to determine each point. There will be need for a stricter definition of some terms such as "clods" and "crumbs," a much longer trial of the "soil compressor," a series of climatic seasons that may give better returns than those hitherto recorded, and results from different farms and from different paddocks on the same farm, which will be more strictly comparable than at present. In short, there will be a series of scientific experiments strictly correlated by one central authority.

But as Mr. Peacock contends that by the adoption of the methods he advocates better returns may be obtained, the Minister has decided that an extended trial shall be carried out at the Wagga, Cowra, and Glen Innes Experiment Farms—50 acres to be treated strictly in accordance with Mr. Peacock's published method as personally explained by him on his own farm, and an adjoining 50 acres to be treated according to the practices which up to the present have been proved to yield the best returns under the conditions of the district.

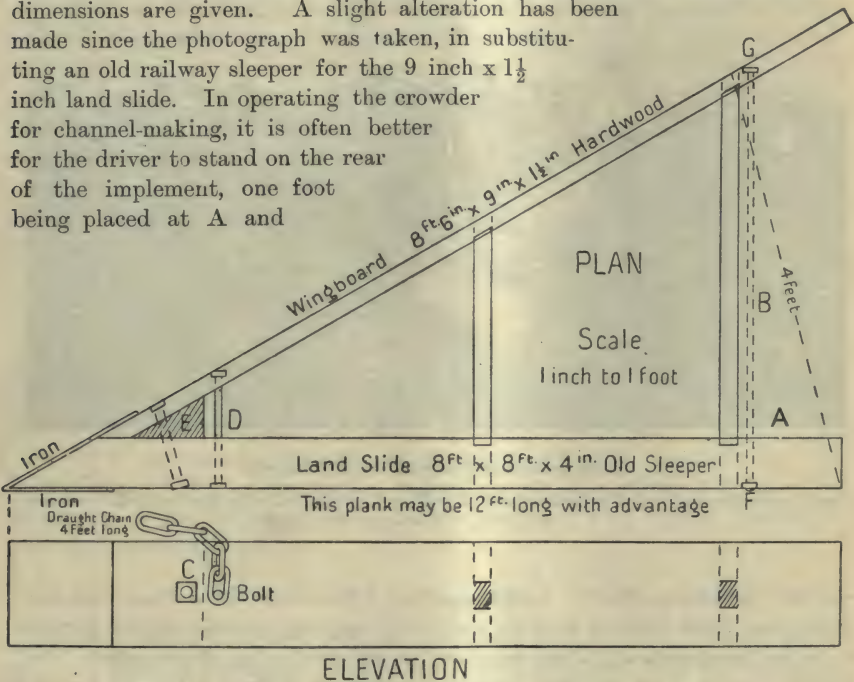
The results of these trials will be published in due course.

Irrigation.

F. G. CHOMLEY, Manager, Yanco Experiment Farm.

Home-made Crowder or Delver.

THE home-made crowder described by Mr. Allen (*Agricultural Gazette*, November, 1908), has been used successfully here for making all the irrigation channels of various sizes. On attached sketch the sizes of timber and other dimensions are given. A slight alteration has been made since the photograph was taken, in substituting an old railway sleeper for the 9 inch x 1½ inch land slide. In operating the crowder for channel-making, it is often better for the driver to stand on the rear of the implement, one foot being placed at A and the other foot on rail near B; he is thus able to manipulate the wing-board, by throwing his weight on or off the wing to suit the work. The draught chain, which should be about 4 feet long, is attached to a bolt running through the sides at D; the chain is brought over the chock E to the swings. When it is required to use the wing-board on the left side, the chain is brought over the chock in the same way on the other side; the implement, of course, is turned over. The point of crowder is shod with strips of bale-iron, but a stout sheet of iron would be better.



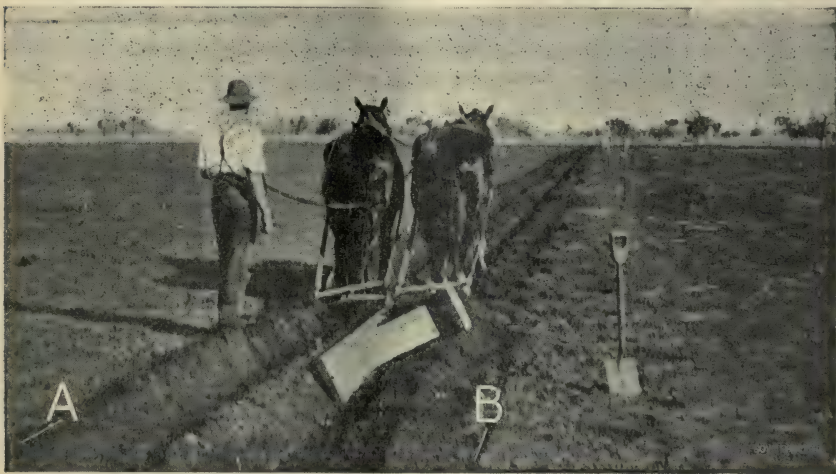
CAUTION - Sink boltheads and nuts in flush, and make strong joints
An iron rod with nuts from F to G would be an advantage

The point of attachment of the draught chain is important. If too near the point, the team will raise it, and the implement will not hold in the ground; if too far back, it roots in too much.

In making a channel with plough and crowder, a small core is left in the middle of the channel. This may be left if channels are not permanent, or removed with shovels in permanent ditches.

I find it cheaper to leave the core and run the one-horse orchard Planet Jr. Cultivator along the bottom.

In striking out for the channel, the width having been decided on, plough two furrows inwards, as shown at A and B on photograph, the width of the



Home-made crowder at work making channels

The channel is about 5 feet from bank to bank (A to B) at the top. The water stands about 1 foot deep and 4 feet wide when in use.

channel including the two banks, say 6 or 7 feet apart for a small channel; then plough two furrows back on each side, but not so close to first furrows as to fill the strike out. Then do a trip up and down with the crowder; then plough one or more furrows according to size of channel, leaving a core for land slide of crowder to run against; this will leave a satisfactory ditch with a small core down the centre. A trip up and down the outside, running the crowder in the first furrows ploughed, will pull the bank together and leave a good ditch.

The longer the land slide the better; a piece of timber 12 feet, or even 14 feet, makes a steadier machine, but it must be square and sharp on the bottom and side next the land or it will not hold.

If the soil is dry and ploughs up lumpy, it may take more than one trip to make a satisfactory ditch, because the wing-board, being merely a straight board, will not work clods up to the top of the bank far enough to prevent them running back; but even in the roughest ground, two or three trips works the channel to the desired size.

Diseases in Stock

WHITE SCOUR AND LUNG DISEASE IN CALVES.

THE disease affecting calves, known as "White Scour," has been recognised for a considerable period. In the early part of last century (1808), an article appeared in the "Veterinarian," describing a violent diarrhœa with inflammation of the umbilicus affecting calves and foals. Since then many observers have recorded their experiences and researches in connection with the disease, until at present our knowledge of the condition, though by no means complete, is fairly full. The geographical distribution of the disease appears extensive, as literature indicates that it is known almost throughout the British Isles, and is also common in France, Germany, Denmark, and other European States. It is prevalent in the United States of America, and has of recent years caused considerable loss in New Zealand and Australia.

In spite, however, of the fact that it has been known in this State for many years, it is only with the development of the dairying industry that it has become of economic importance, since it is essentially a disease of calves on dairy farms which are "poddied" and confined in small pens and paddocks, as opposed to calves allowed to run free and suck their mothers.

At the present time these diseases must be regarded as common affections of calves in many of the largest dairying districts. The mortality varies from 5 to 80 per cent., and so persistent and disastrous has it been on some farms as to threaten the extermination of special high-grade herds.

In 1903 the loss to breeders owing to these diseases was estimated at £10,000, and if this be correct, the annual loss at the present time must be very much greater, as comparatively little has been done by the farmers in general to check the disease.

White Scour.

The affection is so termed from its predominant symptom. It is observed in calves from two to ten days old, rarely later, and then only in a subacute form. Sometimes the disease is rapidly fatal, the calf dying from two to four days after birth. Frequently the attack is slight, and then, after a more or less lengthy period of intermittent diarrhœa, the calf recovers, to fall a victim in a few weeks to the "lung disease."

Symptoms.—The constant sign of infection is the presence of a profuse diarrhœa. The dejections in the early stages are white, with a slight tinge of yellow, and have an unpleasant odour. As the disease advances they become thin and frothy, and contain curds. Shortly before death supervenes a variable quantity of blood may be found mixed with the discharges. The act of scouring is often followed by severe straining, so as to lead to protrusion of the mucous membrane of the rectum, which has an inflamed appearance. Associated with the scouring is abdominal pain, manifested by the calf moaning

STOCK BRANCH. LEAFLET NO. 5.

and crying out. Often the affected calf lies continuously on its side, with head turned round resting on the flank, and shows a great disinclination to move. Frequently the animal gnashes the teeth and saliva flows from the mouth. The hair is dry, dull, and ruffled. Its eye dull, and the mucous membrane of the mouth pale.

In the final stages of the disease the calf becomes extremely weak, so that it is unable to stand without assistance. The eye becomes duller and sinks in its orbit; the flanks tucked up and the abdomen hollow. The nose is dry and hot, and a slight watery discharge flows from the nostrils.

During the acute stage there is high fever—104° F. to 106° F.—associated with great thirst. In advanced stages the temperature is often below normal. The pulse is weak and rapid. In many acute cases the umbilicus (or navel) is enlarged, its vessels corded and painful when squeezed. Under the scab an excessive amount of purulent matter is often present.

COMPLICATIONS.—*Arthritis.*—The presence of arthritis, or inflammation of a joint, has been recorded in connection with "white scour." The joints most commonly involved are those of the hock and stifle.

Brain Symptoms.—Professor Mettam states that brain symptoms are also said to occur as a complication. During the Departmental inquiry, undertaken by Mr. J. D. Stewart, M.R.C.V.S., Chief Inspector of Stock, only one dairyman reported having lost calves with brain troubles—seven had died suddenly in convulsions. Further than the fact that "white scour" affected some of his calves, no definite information could be obtained.

Ulceration or Necrosis.—During his investigations Professor Mettam had the opportunity of seeing upon the farms in Ireland cases of necrosis, involving more especially the soft structures of the mouth.

Post-mortem Appearance.—The lesions observed in acute cases of "white scour," so called, are commonly those of septicæmia and acute infection of the blood.

The degree of emaciation varies according to the duration and virulence of the disease. In acute stages that kill within four days after birth, the carcases may be fairly well nourished. Calves that die after a lingering illness, from the subacute form, are, as a rule, much wasted. The umbilicus may be larger than normal, and thickened, while its cord-like vessels can be felt through the skin. Under the scab, over the navel, there may be an abnormal quantity of purulent matter. In some cases there is a certain amount of effusion in the abdominal cavity. Occasionally an exudate of lymph takes place which adheres the intestines to the abdominal wall. In one case the bowels were adherent to the anterior portion of the bladder. The umbilical arteries passing backwards on the inside from the region of the navel to the pelvis may be found thickened, livid in colour, and containing a blood clot. In acute cases the peritoneum shows general congestion, the vessels standing out prominently. Other serous surfaces of the abdominal cavity frequently show minute extravasations of blood. The first three stomachs are usually

not affected. The lining of the fourth stomach often shows numerous pin-prick-like hemorrhages. In other cases it may be found to be congested or inflamed, particularly about its pyloric end. The organ in these instances contains huge masses of casein. The intestines are usually congested, and often show sub-mucous hemorrhages. The contents of the bowels are usually watery, white, and frothy, and occasionally there is blood mixed with them. The lymphatic glands within the mesentery are enlarged and softened, and may be hemorrhagic. The colour, size, and consistency of the spleen are, as a rule, found unaltered when the examination is made immediately after death. The liver may be swollen, congested, and slightly jaundiced. The kidneys are usually congested; often they are pale in colour externally, but on section the inner zone (medulla) is invariably found congested. The lungs of calves that die of "white scour" after a few days' illness may show no departure from normal. Occasionally in these early cases, and almost invariably when the animal has suffered from "white scour" for a period longer than a week, small affected areas are found about the borders of the lungs, and particularly in the anterior lobes. These patches, which are regarded as the initial phase of lung disease, present a dark appearance, and are firm to the touch (atelectasis). They form a marked contrast with the surrounding healthy, creamy-pink lung tissue. The heart's sac may contain a quantity of straw-coloured fluid (effusion); the heart and pericardium may not appear altered. Occasionally sub-serous extravasations, varying in size from a pin's head to large patches, are seen.

Lung Disease.

It has been demonstrated by the investigations of MM. Nocard, Lesage, and Delmer in France, that there is an intimate connection between "white scour" and lung disease, in that the latter is a sequel to the disease which has "white scour" as its predominant symptom. Many of our dairy farmers who are keen observers have noted that calves that recover from "white scour" subsequently become affected with lung disease.

Symptoms.—The early manifestation of the lung disease may be evident while the calf is affected with "white scour," or may not develop until the animal is apparently recovered, and is two to four months old. The first sign noticed is dullness; the calf stands with head depressed and ears lopped. There is a tendency to isolate itself from its fellows in some warm, sheltered place. The appetite is diminished, the calf comes slowly up to be fed, and after a few swallows appears satisfied. The coat is harsh, dry, and ruffled. The lassitude rapidly increases and fever becomes evident, the nose being harsh and dry. In one case a temperature of 105·6° F. was recorded. The white of the eye acquires a dirty yellowish-red colour, and often there is a copious flow of tears. The pulse is rapid and weak, respiration is hurried and panting, and occasionally the animal emits a dry, painful, suppressed cough. A sticky, glary discharge (muco purulent) flows from the nose, and

becomes more copious as the disease advances. The calf rapidly experiences great difficulty in breathing, and often rests its head on a rail. Immediately before death the animal lies stretched out on the ground, panting violently, and is cold to the touch. The duration of the symptoms of lung disease varies from three days to three weeks or more. With careful nursing a small percentage of the affected calves recover, but invariably remain weaklings until they are at least two years old.

Fig. 1.—Calf affected with modified form of "Lung Disease."

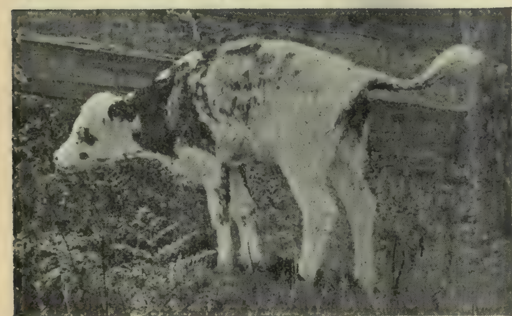


Fig. 2.—Calf suffering mild attack of "White Scour."

Fig. 3.—Calf suffering severe type of the disease.

Post-mortem Appearances.—In calves that succumb to lung disease the various lesions described in connection with "white scour" may be found to persist. In some cases they are very evident and general, in others indications of their pre-existence are only apparent. In advanced cases the changes in the lungs have a resemblance to both broncho-pneumonia and septic hemorrhagic pneumonia. The lungs are occasionally found to be adherent to the chest wall. The lobules vary from bright to dark red in colour, and are well mapped-out by the presence of an interlobular effusion. Portions of the lungs are solid to the feel, and on section show numerous small abscesses containing pus-like material. Consequently, the disease has occasionally been mistaken by farmers for a form of tuberculosis.

Causes.

As the disease affects calves during the first few weeks of their lives, particular attention must necessarily be paid to the methods generally adopted in rearing poddy calves. It is to be regretted that the conditions which largely prevail in most dairying districts are distinctly favourable to the spread and persistence of "white scour." Shortly put, they are as follows:—Cows invariably give birth to the calves whilst depastured in extensive paddocks; within the following forty-eight hours the cow and her calf are brought to the yards, the cow is milked, and the calf taken from her and placed in the calf-pen. Many of these pens are old and dilapidated.

Fig. 4.—An advanced case

They are, as a rule, near the dairy, and often not far removed from the pigsties. Their floors are mostly earthen, and too often in a filthy condition. In these pens calves are kept for several days, until they have acquired the habit of drinking from a bucket. In the meantime symptoms of "white scour" often appear, and one or more calves may die. From the pens the calves are turned into small paddocks, where they are fed from a trough. They are now fed on separated milk or whey, stored in a wooden or iron tub, which is frequently found to be lined with a thick crust of dried milk and dirt. Very often it is never scalded out. The trough is also too often a wooden one, without means of cleansing.

If, now, the cause of the disease is taken into consideration, it will readily be seen to what extent the above conditions are responsible for the prevalence of "white scour."

The infectious nature of the disease was early recognised, and many observers directed their attention mainly to the discovery of the casual microbe. In 1902 Professor E. Nocard, of the Alfort Veterinary College, working in Ireland, and Messrs. Lesage and Delmer, in France, arrived at almost identical conclusions, *i.e.*, that the disease is caused by an ovoid bacterium, which penetrates the system by way of the newly-ruptured umbilical cord. These results have since been confirmed in various parts of the world; but this must not be regarded as the sole cause of "white scour," nor can it be affirmed that every outbreak is due to umbilical infection. That infection may be produced after birth by the newly-ruptured umbilical cord coming in contact with foul matter, such as discharges on the floor, can be readily conceived, but other methods of infection must be taken into consideration. In many cases the *post-mortem* examination will undoubtedly indicate that infection has occurred through the umbilicus, but in many other instances, including severe cases of "white scour," with primary intestinal lesions, no abnormal conditions may be detected in connection with the umbilicus or its vessels. In such cases the lesions may be entirely confined to the fourth stomach and intestines. The stomach is usually congested or inflamed, and contains large masses of casein, even up to the size of a man's head, while the contents of the bowels are watery, white, and frothy, sometimes containing curds and occasionally tinged with blood. In such cases, infection most probably occurs by the mouth. Calves have a habit of licking each other, especially about the umbilicus, scrotum, tail, and ears; and, again, the feeding trough may become contaminated with infectious fæcal discharge, and in either method the calves might readily become infected.

In other cases "lung disease" is the first to break out when the calves are about six weeks old, without the occurrence of any noticeable symptoms of "white scour." In these cases either the attack of "white scour" was so mild as to escape notice, or the calves have become infected by the inhalation of discharges drying on the floors of pens, or on the ground, and becoming reduced to dust.

While, however, it must be kept in mind that this is an infectious disease of bacterial origin, it must not be forgotten that there are other causes which predispose calves to this disease, and they are principally insanitary conditions and improper feeding.

Overloading of the stomach with cold milk, exposure to damp and cold, feeding at too long intervals, feeding with fermented milk, or milk which has been kept in dirty cans, are all predisposing causes, acting by deranging digestion and weakening the constitution of the calf. In cases occurring within two or three days after birth, infection by the umbilicus is probably the only cause, but in those cases delayed for a week or more, the damage done by improper feeding and insanitary conditions must be regarded as a most important factor.

Preventive Measures.

Care with introduced Stock.—Many farmers connect the introduction of the disease into their herds with the purchase of stock from infected farms. With calves there is no doubt a great danger, and farmers should exercise great precaution in their purchases, carefully inquiring as to where the calves were reared, and ascertain that they are in good health. Before introducing them into their herds the calves should be kept isolated and closely observed until they are at least three months old. The sheath and tassel of bulls from infected farms should be well washed and disinfected before service.

Erection of new Calf-pens.—On farms where the disease prevails the calf-pens must be regarded as the chief source of contamination. Although the existing pens might be made harmless by thorough disinfection, the wisest plan is to erect new pens on a site some distance from those now in use. In their construction entirely new material should be used throughout.

Washing the Cow.—When the cow shows signs of being about to calve, the hind parts, including the vulva, anus, escutcheon, and tail, should be washed clean with soap and water, and then cleansed with rain-water containing lysol in the proportion of a teaspoonful to a small bucketful of water. The vagina should also be well washed by injecting rain-water containing 2 per cent. of lysol by means of a large syringe. Under present conditions these measures are hardly practicable and are certainly not likely to be adopted, but as the value of good milking cows rises the farmer will find that it will pay him to take such steps as these to prevent loss, and even now they should certainly be adopted in the case of valuable cows.

Treatment of Calf.—On the cow being brought up from the paddock to the yards after calving, the calf should be immediately removed, and its umbilicus tied at the part where it naturally sloughs off by a ligature of twine soaked in carbolised oil (5 per cent.). The umbilicus should be then well smeared with carbolised oil and afterwards painted with Stockholm tar of the purest kind. The tar should be again applied when the calves are turned into the paddocks.

The Feeding of Poddy Calves.—The present practice of collecting milk for calves in wooden casks and feeding from wooden troughs cannot be too strongly condemned. So long as these conditions prevail some derangement of the digestive organs of calves must be expected. Metal receptacles should be used, so that they can be thoroughly cleansed daily by scalding. To prevent the calves drinking too rapidly, a number of stalls should be erected, and each calf allowed to drink undisturbed from a separate bucket, as is carried out at the Government Stud Farm, Berry. The system of feeding the calves by means of rubber teats approaches nature's method as near as practicable and aids in the assimilation of food. Considerable care is, however, necessary in order to keep the tubes and teats perfectly clean, and in any case where there may be doubt that they will be so kept, miniature bails with a metal bucket for each calf are preferable. The lower half of a kerosene tin

makes an excellent calf-feeding bucket. An allowance of the mother's milk materially assists the calf's development and strengthens its constitution. On

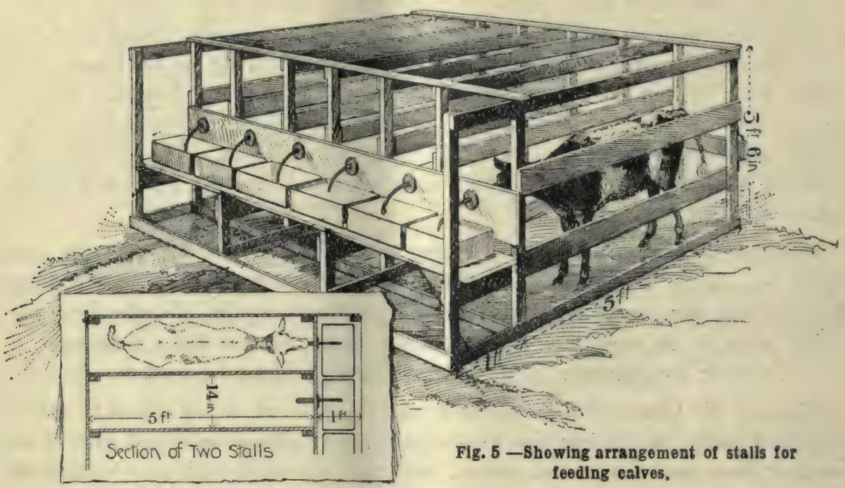


Fig. 5—Showing arrangement of stalls for feeding calves.

no account must whey be considered a sufficient food for calves. The addition of formalin to the milk is also recommended as a further preventative. One ounce of formalin should be mixed with a pint and a half of water and half a teaspoonful of the mixture added to the milk of each calf. A dose of castor oil (2 oz.) should be given any calf showing signs of digestive derangement or scouring, followed by the administration of formalin, as above; but good results from treatment must not be looked for and all efforts should be concentrated on prevention.

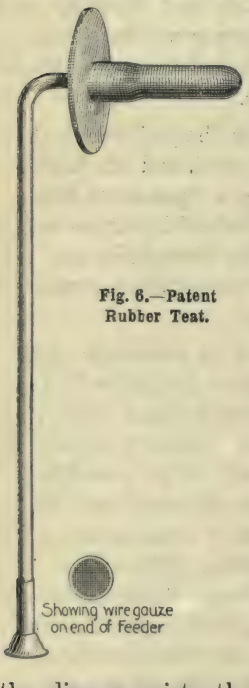


Fig. 6.—Patent Rubber Teat.

Clean Calf-pens.—The calf-pens should be swept out daily. The sides of the pens and shelter-shed should be painted with lime-wash, and the floors sprinkled with disinfectant periodically. Calves showing symptoms of the disease should be immediately removed and isolated for treatment or at once slaughtered. Should the disease reappear the pen must be again thoroughly disinfected. Any of the carbolic fluid sheep-dips diluted with water make a suitable disinfectant for the purpose.

The Calf-paddocks.—On no account should an affected calf be allowed to be run in the calf-paddock. Any calf showing symptoms of the disease should be immediately removed and its dejections either burnt, deeply buried, or disinfected. On farms where the disease exists the necessity of enclosing new paddocks for the calves is strongly advocated.

Clean Milk.

Its Production and Management.

M. A. O'CALLAGHAN.

Cow's milk may be defined as the whole of the semi-opaque fluid secreted by the mammary glands of the cow.

The Composition of Milk.

Before dealing with the changes which may take place in milk while it is in the cow's udder or afterwards, it will be well to here consider the general composition of normal milk, which may be set down as follows :—

Water	87·20	Milk Sugar	4·70
Fat	3·90	Ash or mineral matter	·60 to ·75
Casein	3·0C		
Albumen	·45		100·00

In order to show, however, how the pure milk of different breeds and different individuals may differ under varying conditions from the above standard composition, as well as to show how the morning's milk varies in relation to the evening's, the following tables will be useful for reference.

During the months of June and July, 1908, I caused samples of milk to be taken by my field officers from representative herds in several districts in New South Wales, where the conditions were good, the results of which are shown in the following table :—

Sample.	Date.	No. of Cows.	Morning.			Evening.		
			Total Solids.	Fat.	Solids. not Fat.	Total Solids.	Fat.	Solids not Fat.
			%	%	%	%	%	%
Bowral District	10/6/08	36	12·81	3·95	8·86	13·42	4·55	8·87
Denman do	23/6/08	31	13·84	4·37	9·57	14·64	5·47	9·17
Do do	25/6/08	13	13·00	3·95	9·05	13·54	4·80	8·74
Do do	28/6/08	40	13·33	4·05	9·27	14·47	5·30	9·17
Coraki do	2/7/08	42	11·60	3·70	7·90	12·22	4·20	8·02
Singleton do	11/7/08	50	12·66	4·10	8·56	13·50	4·90	8·60
Do do	11/7/08	72	12·54	3·80	8·74	13·20	4·57	8·63
Alstonville	25/6/08	35	12·78	3·82	8·96	13·39	4·80	8·59

Analysis of ten samples of milk, Berry Stud Farm, after a three months' drought :—

	Ayrshire.		Shorthorn.		Holstein.		Jersey.		Guernsey.	
	Mixed. Morning.	Mixed. Evening.	Mixed. Morning.	Mixed. Evening.	Mixed. Morning.	Mixed. Evening.	Mixed. Morning.	Mixed. Evening.	Mixed. Morning.	Mixed. Evening.
Total solids...	12·26	11·77	11·33	11·69	11·60	11·88	14·19	14·42	13·45	14·34
Solids not fat	8·81	8·13	8·58	8·04	8·40	8·21	9·27	9·07	9·11	8·94
Fat	3·45	3·64	2·75	3·65	3·20	3·67	4·92	5·35	4·34	5·40
Ash	·66	·65	·63	·70	·71	·64	·65	·70	·71	·68

Conditions.—Weather dry, grass scarce, only food given, grass. Cattle, healthy and in fair condition. Samples taken on 27th January, 1909.

The latter table shows clearly that most breeds of cattle yield milk below the average in solids other than fat under abnormal conditions such as a prolonged drought.

Milk as a Germ Food.

It will be seen from the tables, however, that milk contains all the constituents necessary for the support of animal life; and people with a knowledge of bacterial life will recognise also that milk contains all the food that is required, not only to sustain germ life, but also all that is necessary in order to maintain the continuation of a species. Thus it is that nearly all micro-organisms find milk a suitable medium in which to develop.

There are exceptions such as the tubercle bacillus (the germ that causes tuberculosis), because whereas this organism will live in milk, it will not reproduce its species therein, at least not after the milk has left the cow's udder. These and some other pathogenic organisms are accustomed to living in the animal's system at a constant and high temperature maintained by the animal, and when removed from their special habitat they thrive badly unless in specially prepared media kept at about blood heat constantly. For this reason milk is not nearly such a dangerous food when drawn from cows suffering from disease brought about by bacterial agency as is imagined by many people. If, for instance, milk when drawn from the cow, and kept at ordinary atmospheric temperatures, were a suitable medium for the tubercle bacillus to reproduce itself in, it can easily be imagined how even a couple of tubercle bacilli getting into a pail would, in the course of a few hours, so multiply that there would be many millions present before the milk was consumed in the ordinary course, and, therefore, people to whom this milk would have been given would have little chance of escaping from this deadly disease. Happily for man Nature has ordained otherwise, and if there are only two or three tubercular germs in a gallon of milk in the morning the probability is that by next day, instead of increasing, these organisms will not only have not increased in numbers, but will instead have become enfeebled by the actions of the commoner organisms which find milk such a suitable place in which to grow.

The health of a cow in relation to the milk yielded.

Any of various forms of disease may affect a cow without in any way involving the mammary glands, and thus the milk would be to all appearance normal, whereas, owing to the illhealth of the animal, the milk though probably free from pathogenic germs is unsuitable as a food for very young animals or children.

Again, a cow may appear perfectly healthy, and the condition of the body may be normal in every way as far as general appearances go, yet the mammary glands may be involved, as sometimes happens in the case of an animal suffering from tuberculosis or actinomycosis. Then the milk becomes unfit for consumption because of the presence of pathogenic germs, although its appearance is normal.

Milk as it is in the udder of a healthy cow and afterwards.

It may be taken for granted that when milk is resting in the udder of a healthy cow it does not contain bacteria of any kind, but immediately it leaves the udder proper, and enters the teat or milk duct, it becomes open to bacterial influences. The entrance of the milk duct is sufficiently large for the ingress of bacteria, and, as a rule, the traces of milk which remain in the milk duct from one milking to another act as a medium in which bacteria grow in these intervals. If the surroundings are very cleanly the only bacteria that are found in the milk duct of a healthy cow are the germs that might be said to be almost natural to milk, namely, the common lactic acid producing germ known as *bacillus acidi lactici*, with perhaps in addition some harmless species of atmospheric bacteria.

When the process of milking begins, and the milk leaves the udder and enters the milk duct, the force of milk washes the bacteria that are resting in the teat out in the first few streams, and this is the reason that the first drops of milk drawn from even a healthy cow, as a rule, contain a fair number of bacteria, whereas the milk drawn towards the middle of milking contain practically none. If then the first portions of a cow's milk are excluded, and the conditions of milking are nearly perfect, only a harmless variety of atmospheric bacteria should get into the milk pail. Milk so drawn should keep unaffected by bacteria for a considerable length of time, provided of course that the vessel into which the milk has been drawn had been thoroughly scalded, or, practically speaking, sterilised, before the milk was introduced therein.

As milk leaves the cow's teat, however, it becomes, so to speak, a product of its surroundings. If the milk is drawn by hand, the hands of the milker may not have been clean, and in this way whatever species of bacteria was associated with the uncleanliness on the milker's hands will have gained an early start in the milk. The same may be said of the rubber tubes of milking machines which, if not well cleaned, are a fruitful source of bacterial infection.

The worst form of contamination after the milk has left the udder, however, occurs in one of the following ways:—

1. The introduction of traces of the animal fæces into the milk pail direct.
2. The introduction into the milk of germs common to decaying matter in the farmyard.
3. The introduction into the milk of commercially injurious, and possibly pathogenic, germs by the use of impure water in the rinsing of dairy utensils.
4. The introduction into the milk of pathogenic germs through contact with people suffering from an infectious disease.
5. The dropping from the animal's body into the milk bucket of hairs and portions of dry dirt gathered from some dirty water pool in which the cow had been wading some time previously, the dirt obtained therein having dried.
6. The introduction into the milk cans of germs while the milk is in transit by rail or road.

BACTERIAL INFECTION AFTER MILK HAS BEEN DRAWN.

Introduction of Bacteria through the access to the milk of portions of the animal fæces.

When a cow is being milked, it is a very common thing for her to make a deposit in the milking bails, and it is not the general custom to at once remove this manure. The cow herself may not, if the milker has been very careful, have introduced any traces of the manure into the bucket, but another cow comes along in due course and kicks about a bit, with the result that portions of the unremoved fæces frequently gain access to the bucket, and thus introduce into the milk whatever species of bacteria were present in the animal fæces.

Another easy and common method for the introduction of portions of the undesirable secretions is the switching of the cow's tail soon after the animal has defæcated or urinated. At one time a great deal of importance was not attached to contamination of this sort unless the milk was to be utilised for making first-class butter, but since it has been clearly demonstrated that tubercle bacilli are commonly present in the fæces of tubercular cows it has been evident to all observers that this is undoubtedly one of the worst, if not the very worst, possible source of milk contamination.

I do not think that this information is sufficiently widely known among dairymen, who, no doubt, will rise to the occasion when they have been thoroughly informed, and endeavour to prevent contamination of this character.

The introduction into the milk of germs common to the farmyard.

This is a source of milk contamination which is not thoroughly understood by the average farmer for the simple reason that he does not understand the vehicles on which germs may be carried. It may be stated that the germs introduced into the milkpail under this heading gain access thereto from the atmosphere common in the milking bails. If a wind blows from a heap of decomposing vegetable matter in the direction of the milking bails it brings with it particles of dust or vegetable matter, some of which become deposited in the open milking bucket, and thus it is that the milk takes on the fermentations common to the farmyard in which it has been produced. If no decaying matter is allowed within a considerable distance of the milking bails, and if the bails themselves are kept in a perfectly clean condition, it will not be possible for germs of fermentation to be introduced in this way, and while dealing with germs introduced as described, it must be pointed out that as germs of tuberculosis are common to the manure of tubercular cows, and as some tubercular cows are almost certain to be present in every herd of any size, we must assume that it will be possible to introduce tubercle bacilli into the open milkpail, even through the atmosphere which has become vitiated in the way described. As already stated, the great safeguard lies in the fact that any stray tubercle bacilli introduced in this way will not multiply in new milk.

Another cattle disease has, however, to be considered closely with this form of milk contamination, and that is the trouble so common in our young calves, namely, a form of diarrhœa due to the action of micro-organisms, and which is of a highly infectious nature. It seems to me a fair thing that any dairy farmer who supplies milk for the purpose of consumption as milk, should, if he keeps calves, and this trouble breaks out in his calf-shed, be compelled to give notice to the company to whom he is supplying the milk, so that they may keep his supply separate, and utilise it if they think fit for butter-making or something else other than for drinking purposes. In the summer time when calf diarrhœa is so prevalent, medical statistics show that infantile diarrhœa is also common, and it does not require any stretch of imagination to connect the two things. If the fæces from an affected calf is not destroyed but is left to remain about the farmyard, by-and-bye it becomes sufficiently dry to be carried by gusts of air into the milking bails or direct into the milking bucket.

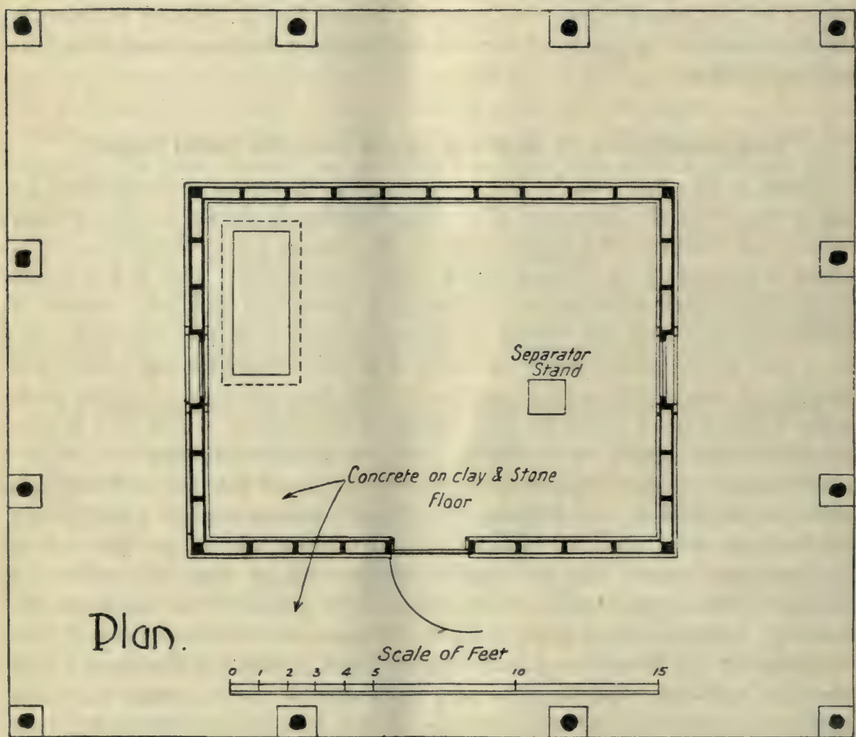
The introduction of injurious germs from the water supply.

There is also the risk of the water supply becoming contaminated by the germs from the farmyard if any carelessness is shown in this matter, because a rainstorm washes the germs of the farmyard into the closest creek, which is frequently the source of the farm water supply, and if the dairy utensils are rinsed with cold water from such a source a sufficient number of germs will have been left behind to cause trouble, not only to the milk company, but to the butter-maker as well. For this reason among others the practice of rinsing milkpails in cold water after they have been scalded with warm water is not a desirable one. Many of the diseases which milk is supposed to be the means of conveying from one person to another are water-borne diseases, such as typhoid, and are only introduced into the milk through some carelessness in water supply such as allowing sewage washings or the drainage from manurial deposits to have access to the source from which the water is drawn. It does not necessarily follow that this access of sewage germs to the water supply should be evident. In other words, there is a contamination apart from the surface-water contamination. The washings of the farmyard may be borne some distance underground and percolate into the water supply at a place where the dairyman may not suspect any possibility of trouble. Hence it is that any water used in connection with the cleansing of dairy utensils, especially if the farmer is a supplier of new milk for the purpose of consumption as milk, should have the closest personal supervision of the person responsible for the management of the farm.

(To be continued.)

A Standard Dairy.

In order to afford guidance to dairy farmers as to the most economical and satisfactory class of dairy building to construct where the herd milked numbers from forty to eighty cows, the Chief Dairy Expert has conferred with the Government Architect and Mr. A. Brooks, of the Hawkesbury Agricultural College. As a result of their deliberations, the following suggestions are made in connection with the plans and specifications of a class of building which they consider will be found to be suitable in all respects for the designed purpose.



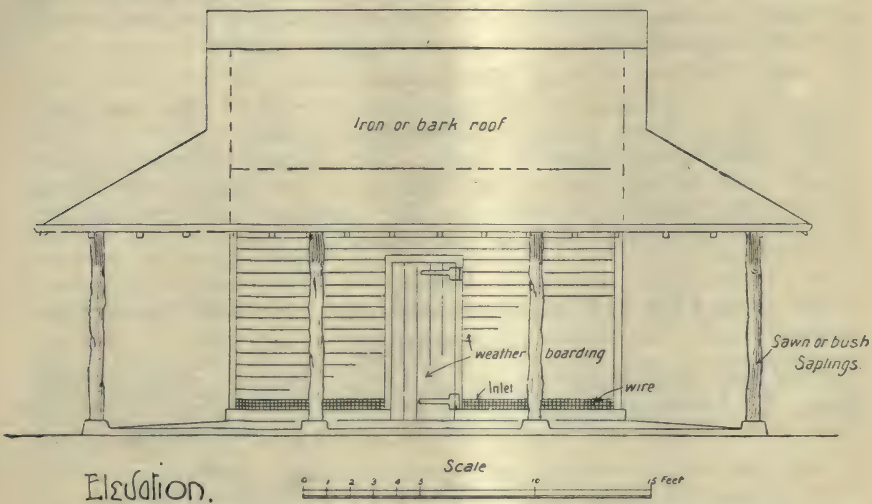
The dairy is 12 feet x 16 feet and 12 feet to ceiling, with verandah on all four sides. This, of course, might not in all cases be considered necessary, as a verandah on three sides might be found quite sufficient. It is constructed of wood, with galvanised iron roof and with concrete floor.

The cost is estimated at £80* in any district where the cost of material is equal to that in Sydney, although any practical man will understand that the cost of construction must be governed in all cases by local considerations as well as by aptitude to adapt existing circumstances.

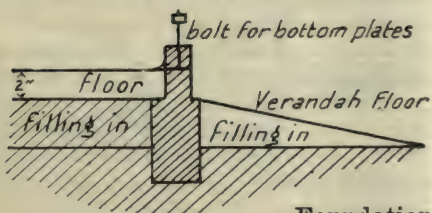
* Some farmers may find it more convenient to obtain all the materials cut ready to erect. For these a leading Sydney firm quote about £55.

Material.

	in. in.
Bottom plates	4 x 3
Top plates	4 x 2
Com. studs	4 x 2 at 18 in. centres.
Corner studs	4 x 4
Ceiling joists	6 x 2 at 24 in. centres.
Collar-ties	4 x 2 at 24 in. centres on each pair rafters.
Battens	3 x 1 to suit corrugated iron.
Gable-studs	3 x 2 over com. studs.
Rafters	4 x 2 24 in. centres.
Ridge and hips	6 x 1
Verandah plate	6 x 2½
Weather-boards	...... Rusticated pattern preferred.
Lining-boards	6 x 0½ T. and G. on walls, 6 in. x ⅝ in. on ceiling.
Bracing for walls	3 x 1 hardwood battens.



All the timber hardwood, with the exception of lining boards, which of course would be of pine.



Floor-level.

The floor-level should be at least 12 inches above the natural surface of the ground, and the verandahs all round formed with good slope outwards.

Foundation Walls.

The foundation walls should be from 4 inches to 6 inches above the floor surface, so that the water used in washing down will not enter through the ventilators, or rot the bottom lining-board. The wall framing should be secured with a few ½-inch bolts and nuts to the concrete footing walls.

The Verandah.

The verandah might have round posts let into the ground, unless in districts where the white ant is troublesome; then they require to be set on blocks of stone, concrete, or bricks.

The Roof.

The roof would be better to be hipped, as being more easily ventilated, although more difficult to construct. It should have good overhanging eaves, with sufficient gutter to carry rain water, which, without the guttering, will drive through the top ventilators. For the verandah roof, no rafters other than the corner or hip rafters would be necessary; the 6-feet sheets of iron could be fixed top and bottom to the wall and front plates, and bolted at the lap between.

The Floor.

The floor will be of Portland cement concrete, rendered smooth, and graded to deliver the drainage through end wall at cream cooling tank, and over a gully or a surface drain outside.

Windows.

The two windows of standard size marked on the ground plan should have wire gauze screens, either fixed with screws or hinged, so that they can be taken off or opened up to clean the windows when necessary.

Ventilation.

A ventilator, as marked on the plan, should be fitted to the roof, and a louvre 2 feet x 15 inches should be fitted at both gables.

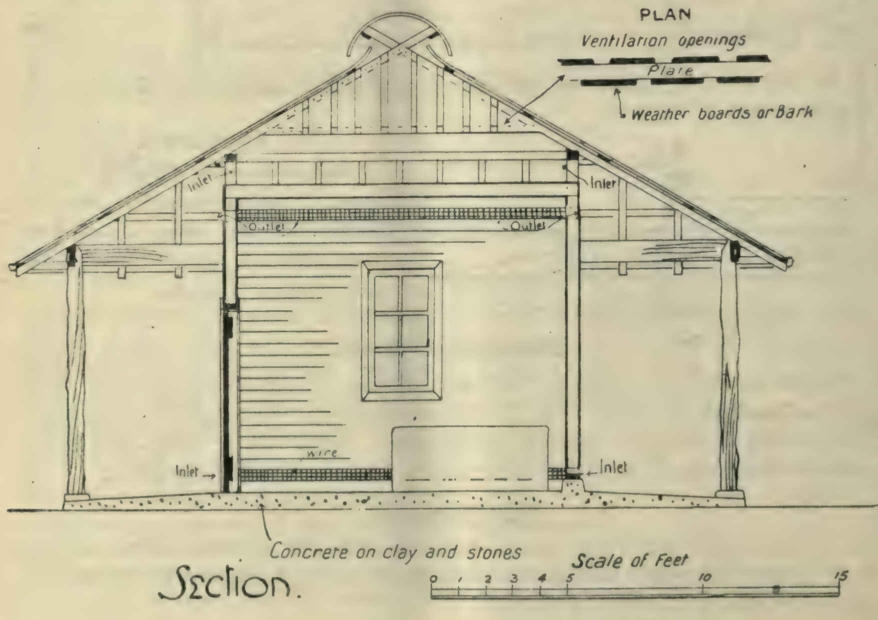
To provide for ventilation and current of air through the dairy, a board should be left on both sides, top and bottom, and the space at the bottom covered with perforated zinc, while the top space can be covered with perforated zinc also, or with bird-cage wire netting.

Door.

The door is 3 feet wide by 7 feet in height, but a standard size door may be used.

Inside Fittings.

Brick basin for cooling cream, 5 feet x 2 feet x 2 feet deep, shown in dotted lines. The bottom of the basin should be at least 6 inches from the floor, to allow of the water being run off occasionally, when it needs cleaning. It can



Section.

be made half-brick thick and rendered with cement on both sides, and it should be supplied with an overflow pipe 3 inches from the top.

Separator stand shown in dotted lines in plan.

Painting.

The roof iron might be painted with some cheap mixture of roof-cooling paint.

The whole of the walls inside and out, and ceiling, should receive three coats of white paint—white lead and linseed oil (half boiled and half raw).

Top Prices for Bad Cream.

The Minister of Agriculture is in receipt of a report from one of the departmental dairy instructors which reveals a serious state of things in connection with a butter factory in an old and highly-favoured district.

It appears that the selling agents of the factory in question notified the Department that the directors desired the services of an officer "to find out what was wrong with their butter, as of late that submitted for grading and export had not graded well." The dairy instructor accordingly visited the factory, and on his arrival met the chairman, two directors, and the secretary—all suppliers to the factory. These gentlemen appeared to be well satisfied with the existing state of affairs, and pointed out that they received top price for nearly all their butter. The officer found that the cream was received three times a week, and also about 200 gallons of milk came in daily.

On grading the cream, the instructor found that the bulk of it was "unclean." Among the unclean lots was the cream of one of the directors of the factory, who, on being informed that failure to clean his separator at night was probably responsible for the trouble, said, "Well, if that is the case, then that can (pointing to a can of cream), should also be graded second; he does not wash his separator at night."

Of thirty-two cans graded, seven were second class the first day, but on next receiving day there was a marked improvement, due, perhaps, to knowledge that the creams were to be examined, and four cans only were found to contain second-grade cream. The cream of the director passed as first class, due, no doubt, to the cleansing of his separator.

Inspection of the farms from which the inferior cream had come revealed a disgraceful state of affairs. In one dairy, fowls had been allowed to roost on the rails between the bails, and the milking sheds presented the appearance of a dirty fowl-house, while the yards had not been cleaned up for a considerable time. The cream from this place had been constantly bad, yet top price had always been allowed for it.

At the next farm visited the bails were unclean, and the dairy evil-smelling and filthy. Bad as the condition of the dairies and their surroundings were, it was also evident that a large number of suppliers neglected to clean their separators after use. However, since the visit of the dairy instructor, a marked improvement has taken place in the quality of the butter, which shows that the whole trouble was due to carelessness, engendered and allowed to be become habitual through the very bad practice on the part of the factory management in paying the same price for good and bad cream alike, and the very much worse practice of the company which disposed of the output allowing top price to the factory supplying inferior butter, notwithstanding the fact that they never actually got top price for it, but by some mysterious juggling the "manager fixed it up, and returned top price to the factory."

Mr. Perry, who is anxious to maintain the superiority of New South Wales butters over all others, trusts that the facts now published will serve to bring home to all concerned in dairying the great amount of injury and loss that the industry may sustain through ill-directed liberality on the part of those responsible for factory management, and through carelessness on the part of suppliers; and he is of opinion that the top price might be higher if closer attention were given to the matters under review.

Government Stud Bulls available for service at State Farms, or for lease.

Breed.	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Dora's Boy ...	Cornish Boy ...	Lady Dora ..	Wollongbar ...	*
,, ...	Royalty ..	Royal Duke II..	Plush ...	Tuckurimba (near Coraki).	6 June, '09.
,, ...	Pansy Duke ...	Earl March ...	Pansy 4th ...	Wollongbar Farm.	*
,, ...	March Pansy ...	Earl March ...	Australian Pansy	Grafton Farm ...	*
,, ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd.	Berry Farm ...	*
Jersey ...	Thessalian II ...	Thessalian ...	Egyptian Princess	Steve King's Plains (near Coraki).	8 June, '09.
,, ...	Golden Lord ...	Golden King ...	Colleen ..	Wagga Exp. Farm	*
,, ...	Sir Jack ...	Omelette's Pride	Lady Tidy 3rd (imp.).	Berry Farm ...	*
,, ...	Berry Melbourne	Melbourne ...	Rum Omelette	Berry Farm ...	*
Guernsey ...	Gentle Prince ..	Rose Prince ...	Gentle ...	Coraki	Sept., '09.
,, ...	The Admiral .	Hawkes Bay ...	Vivid... ...	Wollongbar Farm.	*
,, ...	Prince Milford..	Rose Prince ...	Flaxy ...	H.A.College, Richmond	*
,, ...	Vivid's Prince...	Rose Prince ..	Vivid ...	Upper Orara ...	Jan., '10.
,, ...	Prince Edward..	Rose Prince ...	Vivid ...	Woodburn	21 Oct., '09.
,, ...	Star Prince ...	Calm Prince ...	Vivid ...	Alstonville District	17 Dec., '09.
,, ...	Prince Souvia ...	Vivid's Prince...	Souvenir ...	Wollongbar Farm.	*
,,	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Paterson District	Oct., '09.
Red Poll ...	The Judge ...	Barrister ..	Lovely 8th ...	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General... ...	Judy 9th ...	Bathurst Farm ...	*
,, ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
,, ...	Auchenbrain Spicy Jock (imp.).	Howie's Spicy Robin.	Another Mayflower	Berry Farm ...	*
,, ...	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
,, ...	Jamie's Ayr ...	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
,, ...	Emerald's Mischief.	Prince Emerald	Miss Prim ...	H.A.College, Richmond	*
,, ...	Dado	Daniel	Dot	H.A.College, Richmond	*
Kerry	Bratha's Boy ...	Aicme Chin ...	Bratha 4th ...	Glen Innes Farm...	†
,, ...	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Dexter Kerry	Waterville Punch.	....	.. ..	Grafton Farm ...	*
Holstein ...	The Hague ...	President ...	Lolkje Veeman	H. A. College, Richmond	*
,, ...	Obbe II ...	Obbe ...	La Shrapnel...	Wollongbar Farm	*
,, ...	Hollander ...	Bosch III ..	Margaretha ...	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

The Composition of various Silage Crops.

F. B. GUTHRIE and A. A. RAMSAY.

As inquiries are often received from dairy farmers and others interested in silage as to the composition and feeding value of various crops suitable for ensilage in this State, we have collected from American sources the following details as to the analysis of various crops used largely in other parts of the world for fodder, and these, together with the results of analyses made in the Departmental Laboratory of samples grown in New South Wales, it is hoped will serve to indicate their relative value for silage purposes:—

	Water.	Ash.	Crude Protein.	Crude Fibre.	Nitrogen Free Extract.	Fat.
Corn silage—mature corn	73·7	1·6	2·2	6·5	15·1	0·9
Corn silage—immature corn ...	79·1	1·4	1·7	6·0	11·0	0·8
Corn silage—ears removed... ...	80·7	1·8	1·8	5·6	9·5	0·6
Clover silage	72·0	2·6	4·2	8·4	11·6	1·2
Soy bean silage	74·2	2·8	4·1	9·7	6·9	2·2
Cowpea vine silage	79·3	2·9	2·7	6·0	7·6	1·5
Field pea-vine silage	50·0	3·6	5·9	13·0	26·0	1·6
Sorghum silage	76·1	1·1	0·8	6·4	15·3	0·3
Corn-soy bean silage	76·0	2·4	2·5	7·2	11·1	0·8
Millet-soy bean silage	79·0	2·8	2·8	7·2	7·2	1·0
Cowpea-soy bean silage	69·8	4·5	3·8	9·5	11·1	1·3
Rye silage	80·8	1·6	2·4	5·8	9·2	0·3

The following are the analyses of samples of silage submitted from various farms in New South Wales:—

	Water.	Ash.	Crude Protein.	Crude Fibre.	Nitrogen Free Extract.	Fat.
Self-sown barley, with various other plants.	60·5	5·3	4·1	8·6	19·4	2·1
Wheat and wild oats	35·2	4·8	5·0	15·4	37·7	1·9
Maize, stalk and leaf	64·0	2·2	3·1	11·0	19·3	0·4
Lucerne, prairie grass, marsh mallow, thistles—Top of stack.	55·0	5·1	8·4	8·9	21·2	1·4
Lucerne, prairie grass, marsh mallow, thistles—Bottom of stack.	68·3	3·1	6·7	12·8	6·6	2·5
Very rough lucerne, made in hot weather, January.	52·8	3·4	8·5	13·7	19·9	1·7

The samples of the locally-prepared silage had undoubtedly lost water on their way to the laboratory and the figures do not represent their true condition in this respect.

The amount of acidity present was not determined, but in all cases, even in sweet silage, a slight amount of free acid is present. This acidity is no doubt of some assistance in the digestion of the fodder.

Digestibility of Silage.

With regard to the question of the digestibility of silage as against that of the original crop from which it is produced, it is generally recognised that it is about the same as that of the dried fodder (hay), both silage and hay being slightly less digestible than the original green fodder. This lower digestibility is not due to any actual increase of indigestible material, but to the fact that there is always a considerable loss in the conversion of the green crop into hay or silage (apart from the loss of water), and that this loss chiefly consists of sugar and similar soluble substances, which are wholly digestible.

A loss of as high as 20 per cent. of material is possible in the conversion of green crop into silage, and the material so lost is for the most part the digestible portion of the fodder.

On the whole there is less loss of material when the crop is converted into silage than in the case of field-cured crops, and the silage, if properly prepared, is much more succulent and palatable to stock.

If the fodder in drying is exposed to rain a very considerable loss of material results, whereas in the conversion into silage such conditions can be avoided.

The following table, which is taken from Jordan's *The Feeding of Animals*, is instructive, not only as showing the superior digestibility of corn silage as against dried corn fodder, but also the greater digestibility of these products where made from mature, as against those made from immature maize:—

	Digested from 100 parts organic matter.					
	Corn Fodder.			Corn Silage.		
	Max.	Min.	Average.	Max.	Min.	Average.
Cut before haying (13 experiments) ...	71·4	53·6	65·7	77·8	56·6	67·4
Cut after haying (10 experiments) ...	74·2	61·2	70·7	80·2	65·2	73·6

These figures are obtained from actual digestion experiments and point to the desirability of cutting the maize when just ripe for the purpose of ensilage.

Material such as oats and grasses which form constituents of some of the samples of ensilage examined are probably more economically disposed of by drying than by conversion into silage.

Mutual Agricultural Insurance Societies.

In France enormous strides have been made in the matter of mutual insurance societies among the farming community. At the present time there are scattered throughout the country 8,780 societies in which the farmers insure their crops and stock against accidents and disaster. Of this number 7,241 societies dealing with 53 banks confine their operations to insurance of farm live stock; 1,442 take fire risks with 16 banks; and 24 societies in the vine-growing districts accept risks against the ravages of hailstorms. The live-stock insurance societies have a membership of 398,375 members, and in June, 1908, the value of the cattle insured was set down at 429,209,667 francs (about £18,000,000). The fire insurance societies have 31,964 members with property valued at 277,556,706 francs.

Fruit-growing.

W. J. ALLEN.

In the State of New South Wales can be found soils suitable for the growing of all English fruits, large and small; citrus fruits, nuts, grapes (either table, wine, or those suitable for making into raisins), sultanas, currants, as also pineapples, passion-fruit, custard apples, bananas, &c. English fruits will do well in many parts of the State; but if required for long-keeping or for export, the fruit grown on the higher and colder country is best for these purposes; while the citrus fruits which up to the present have proved the best for export, are those grown at some little distance from the coast and in our back country.

Fruit-growing is a Business.

If any man hopes to make a commercial success of fruit-growing he must make a business of it, and it is a business which requires peculiar adaptations on the part of those who would follow it successfully. It is frequently noticed that two men living side by side and working under similar conditions do not always have equal returns; the one will make a commercial success of his business whilst the other will fail dismally; and so it is with all industries. We cannot all be successful with sheep, but perhaps the man who may fail with fruit might do well with sheep, while his more fortunate neighbour who has made a success of fruit-growing might fail if he undertook wheat-growing.

How to Establish an Orchard.

Before beginning it is well to consider why you are going to grow fruit and for what purpose; as, if it is only proposed to grow sufficient for household purposes, only a small orchard of assorted fruits would be required; whilst, on the other hand, if it is intended to plant a commercial orchard it will not be necessary to plant many varieties; and if the export market is to be exploited, then only such varieties as are of good quality, colour, well, and will carry, should be planted. Again, if the fruits are intended for curing, either by sun-drying or in the evaporator, only such varieties as will make the finest finished product should be grown.

Importance of Suitable Site.

When once it is decided to plant an orchard, it is well to pick only the best land and location available. Worthless varieties can be reworked to better ones, but errors arising from faulty location are generally irreparable. Again, the means of getting the fruit to market must not be overlooked, as having to cart perishable products over uneven roads for long distances is not conducive to their wellbeing or keeping qualities. Some of our successful growers are living from 10 to 15 miles from the railway and still are doing well, yet at the same time the man who is growing fruit within a mile or two of the railway station or wharf, where the boat can pick up his fruit,

has a great advantage over the grower who lives at some distance from such transport facilities. When, too, opposition is the life of trade, and in these enlightened days competition is becoming keener every year, the orchardist should be careful to utilise only the very best soil he has; as he is working at a disadvantage if he cannot grow as many cases of marketable fruit to the acre as his neighbour. Therefore, before planting an orchard, see that the site is a suitable one. Avoid low-lying land if suitable soil can be procured at a higher level. Such a soil will be easily drained, should it ever be found necessary to resort to artificial drainage, and, too, such a site will ensure better "air drainage" than on lower levels, where cold air settles and where frosts are more frequent and severe than on the higher levels. The observer will notice that at night the stock usually choose the higher levels during cold weather for their camping places, thus avoiding the colder atmosphere of the gullies; and it is well known that orchards on the lower levels frequently suffer severely from late frosts, even at times to the extent of the whole crop being destroyed, while orchards on the higher levels have escaped.

It is best not to plant on steep hillsides, as there is always more or less trouble where cultivation is practised, with the soil washing away. It is also more difficult to cultivate, prune, spray, and handle the crop on slopes, than on more even country. Therefore, where possible, avoid planting on land which is very uneven or which has steep grades. I know of several orchards planted on hillsides in districts where the rainfall is good and where such thorough cultivation as is necessary in dry climates is not absolutely essential. These, however, are in districts where land is scarce owing to the mountainous country; and where, therefore, it is necessary to make the most of every acre, and while the owners are doing well they are the exceptions.

Aspect.

For English fruits I am inclined to favour the easterly aspect, as I have usually found such orchards doing well. For citrus orchards and passion-fruit I incline towards a westerly aspect, as possibly being best, as during cold frosty mornings the thawing process would be more gradual and frosts would not be so likely to damage either fruit or foliage to the same extent as they would those vineyards or orchards planted on an easterly aspect.

On the other hand, apples require plenty of sun about the time they are ripening to help colour them, and the more colour we can get on the early export apples the better prices they will command in the European or any other markets.

Varieties to Plant.

This is a question concerning which it is often found rather difficult to give advice, as we have not yet had sufficient experience in fruit-growing in all parts of the State to enable us to say which varieties are the very best to grow under every condition of soil and climate found in this large territory. It is well to remember in choosing varieties, that the population of Australia is not very great, and that we will eventually depend on the export

markets to find sale for our surplus apples and good carrying varieties of pears (which will be late or winter varieties), as also evaporated fruits.

It is well for beginners to take a good look around the district in which they purpose planting, and to find out which of the locally grown varieties are doing best and whether the best is a suitable variety to grow, always keeping in mind that a well-coloured, early autumn apple which will keep fairly well and is not subject to all diseases (such as bitter pit, woolly aphis, powdery mildew), and one which hangs well (such varieties usually have a long stem), is to be preferred if it is possible to get it.

We have Inspectors under the Fruit Pests Act in many districts throughout the State, and they have endeavoured to find out the varieties which have succeeded best in the respective districts, and while these may not be the best varieties that might be grown, I give them for what they are worth on pages 513–515; but in many cases it will be found that the sorts which are being grown are not of the most value commercially, and such as I would not recommend planting even though they may do well in the districts mentioned.

There are only a few varieties of peaches, apricots, and prunes worth growing for drying purposes. Peaches and apricots usually give best results when grown in our warmer climate under irrigation if they are intended for drying purpose.

Stocks.

The nurserymen should supply the grower with the name of the stocks on which the young trees are grown, and should supply strong, healthy trees. If apple and pear trees have been headed low in the nursery there is no objection to 2-year old trees, in fact, they are, if anything, better than yearlings, but for oranges, lemons, peaches, plums, cherries, nectarines, &c., well-grown yearling trees are the best.

Laying out the Orchard.

The following are the numbers of trees to the acre when planted :—

NUMBER of Trees to the Acre.

Distance.	Number per Acre.	Distance.	Number per Acre.
feet.		feet.	
2	10,890	13	257
3	4,840	14	222
4	2,722	15	193
5	1,742	16	169
6	1,201	17	150
7	889	18	134
8	680	19	120
9	537	20	108
10	435	22	90
11	360	24	75
12	302	25	69

Some prefer the square and others the equilateral triangle method of laying out the orchard. With the latter system the trees are more evenly spaced and a greater number of trees are required to the acre than when planted

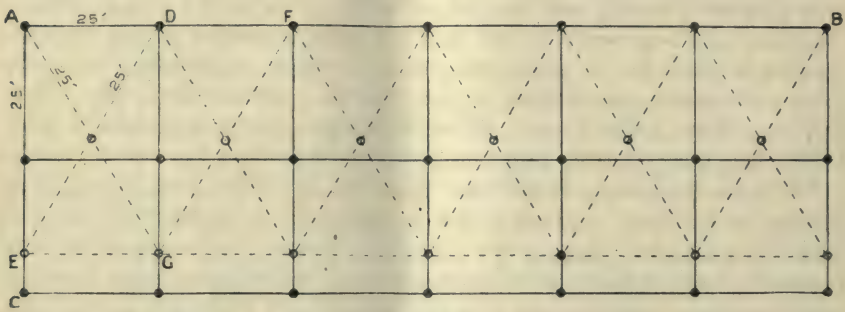


Fig. 1.

on the square system. The diagram, as shown above, will serve to illustrate both methods. The numbers of trees planted to the acre are as follow:—

Equilateral triangle, 20 feet apart, 125, square, 108
" " 25 " " 79 " 69

Where the orchard is to be laid out on the square the base line would be between A B, and staking out line would be stretched between A and C. In laying out the orchard on the equilateral triangle the same base line would be used, but the line would be stretched between D and E, thence F and G, and so on until the whole orchard was pegged out.

Fig. 2.—Double staking board, digging holes, and planting trees.

After laying out the orchard systematically the area could be double staked, after which the holes can be dug, just before the trees are planted, while the soil is still moist.

Planting.

Before planting, the roots should be examined closely, and all bruised or broken roots cut away with a sharp knife or pruning shears. It is not necessary to leave roots longer than from 6 to 8 inches on the young tree. In planting, one person should hold the young tree in an upright position with the butt of the tree in the notch in the centre of the staking board, whilst another fills in the loose moist soil around the roots. These roots should be spread in their natural position and the soil well worked in around them. This can easily be done by quickly raising and lowering the young tree an inch or two while the soil is being replaced in the hole, after which it should be firmed and loose soil thrown over the top. It is not advisable to plant while the soil is sticky, but rather when it is damp and friable.

Pruning.

After planting, the young trees should be cut back to within 12 to 15 inches of the ground (Figs. 3 and 4), and if, at any time, the sun is hot enough to burn the trunks of the small trees, these should be protected by wrapping them with hessian or sacking, or protecting them with palings or anything which will prevent the sun from damaging them.

Fig 3.—How a deciduous tree hould be cut back at planting.

Fig. 4.—How a citrus tree should be cut back at planting.

To a beginner, the cutting back so hard of the young trees seems rather drastic treatment, but failure to do as recommended will produce a tree with long spindly growth, with practically all the new wood at the tips, which is not desirable.

Figs. 5 a, b, c, d, e, and f show how a tree which has been allowed to retain three branches at planting time is pruned during the first three

Fig. 5a.—Headed back to three branches at planting.

Fig. 5b.—First summer growth.

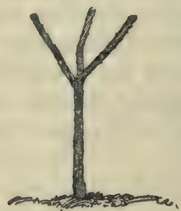


Fig. 5c.—First winter pruning.

Fig. 5d.—Second summer growth.

Fig. 5e.—Second winter pruning.

Fig. 5f.—Third summer growth. This should be cut back in the third winter pruning as indicated by small lines.

winters. Figs. 6 a, b, c, d, e, and f show how a tree which has been completely headed at planting is pruned during the same stages. It will be noted that the tree upon which branches were left at planting has gained no advantage over the headed tree.

During the first three years or more of the tree's life, we continue to cut back severely in order to build up a stocky tree, with fruit spurs from the base to the point of the limbs.

In pruning trees the operator must study each individual tree, and so train it by systematic pruning that it will develop good bearing wood throughout the tree, in order that when it starts cropping the fruit will be borne through the centre and lower portions of the limbs; in other words, from the base to the tips of the branches; being particularly careful to encourage fruiting wood along the main branches, which are sufficiently

Fig. 6a.—Completely headed at planting.

Fig. 6b.—First summer growth.

Fig. 6c.—First winter pruning.

Fig. 6d.—Second summer growth.

Fig. 6e.—Second winter pruning.

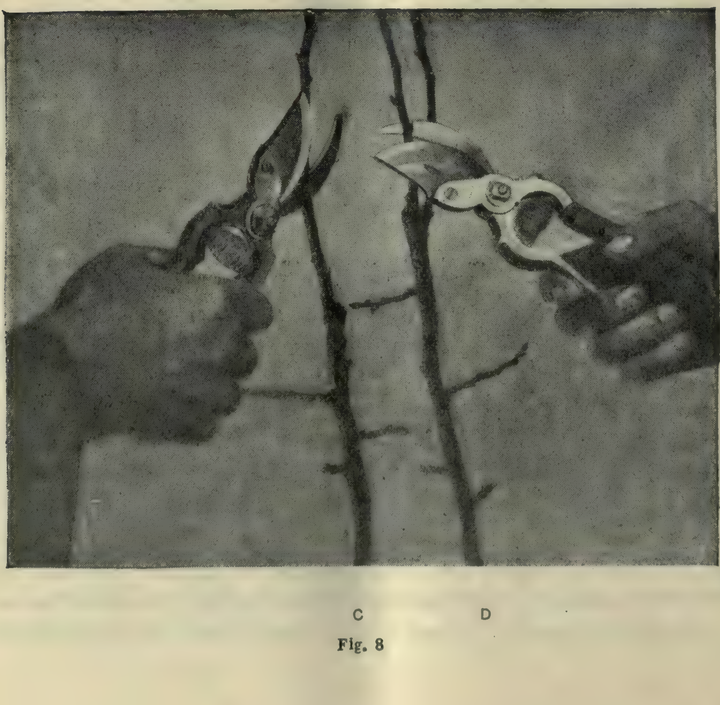
Fig. 6f.—Third summer growth. This should be cut back in the third winter pruning as indicated by small lines.

strong to carry heavy crops without bending and breaking, rather than out on the terminal branches, which are weaker and more apt to be damaged by the weight of the fruit during windy weather or, in fact, any time, as the strain may be sufficiently heavy to break them.

The operator must give due consideration to shaping the tree so that spraying, fruit thinning, and picking can be carried out in the easiest and most expeditious manner. Trees which branch near the ground with low

A B

Fig 7.



C D

Fig. 8

obliquely-rising heads will be found the most convenient form of tree for all purposes. This form of tree with properly spaced branches attains superior strength, and by virtue of its strongly-knit branches and by its strong, stiff, obliquely-rising growth will withstand weight which would bring horizontal branches to the ground.

By forming a low-headed tree the trunks are protected, and in consequence sunburning is avoided.

Fig. 9.—A badly pruned and neglected tree.

Before attempting to prune a tree, it is necessary to know the proper way to handle the shears to make a clean cut that will heal quickly, and to avoid bruising the buds and wood. In Fig. A the shears are held properly, but the bruise will be on the portion of the branch remaining instead of upon the part that is removed. In Figs. B and C the shears are held properly, and the cut is being made properly. In Fig. D the shears are held upside down, and the portion of the branch remaining will be bruised instead of the portion severed.

By following some proper system of pruning, which includes the thinning out of all bearing shoots which are in excess, shortening back others, and by

Fig. 10.—A 4-year old peach-tree before pruning.

the removal of an occasional branch when it has become misplaced, as well as judicious thinning of the fruit, regular crops of average sized fruit will be assured. Regulating the amount of fruit grown in one year involves the profit of two years, as a tree cannot produce an abnormal crop of fruit and perfect fruit buds for the following year. A weakened tree may even blossom profusely, but it often fails to set much, if any, fruit; consequently pruning for a reasonable amount of bearing wood should always be borne in mind—pruning rather severely the winter previous to the expected heavy crop and rather lightly before the light crop.

Fig. 11.—The same tree pruned.

By following such a system the alternate year habit will, with at least a good many varieties, be broken up. One requires to study each different variety to be able to prune it to the greatest advantage, as some of our good varieties

do not form short fruiting spurs—for instance, the Jonathan, Rome Beauty, Irish Peach, and other varieties of apples have but few short spurs but bear the fruit chiefly on twigs from 4 to 6 inches long. On the other hand, the Five Crown and many other varieties throw out an abundance of short spurs throughout the whole length of the limbs, and are naturally

Fig. 2.—Two peach branches before pruning. These branches are covered from base to tip with fruit buds, and if left there would be too much fruit set for the tree to mature.

easily shaped and pruned. We also find that by following a close system of pruning year after year, with some varieties, that they will continue to throw strong wood and will not bear well. In such cases it may be advisable to refrain from pruning for a season, or else prune very lightly for a season or two until the tree develops fruit buds and begins bearing, after which it may

Fig. 13.—The same two branches pruned. It will be seen that some of the side shoots have been removed entirely, and about two-thirds of those remaining have been cut away, still leaving quite enough fruit buds for a good crop.

receive an annual pruning. Again, we have varieties such as the Cleopatra, which requires a very open system of pruning in order that the sun may reach the inside of the tree and the fruit, otherwise this particular variety will take Bitter Pit badly, particularly when the tree is pruned so as to form a dense, close head. The Carrington also requires this system of pruning in order that the sun may reach the fruit and give it a good colour. And so we find that many of our varieties have peculiarities which must be understood before we can prune them after a system which will enable the grower to make the most out of each tree. This refers more particularly to apples, as the better varieties of peaches, apricots, plums, &c., usually throw out plenty of fruit-bearing wood, and the system of pruning is very similar.

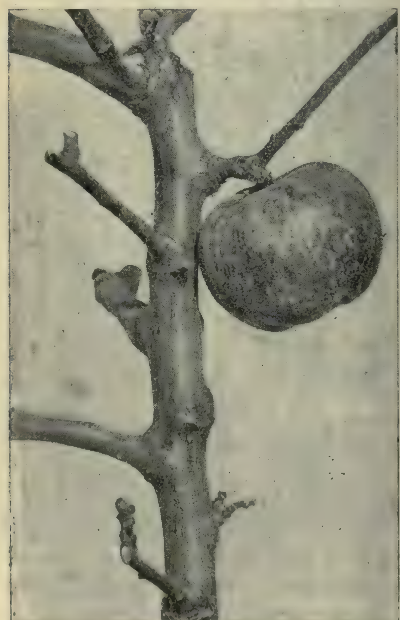


Fig. 14.—Branch of an apple-tree, showing spurs carrying fruit buds for next season's fruiting

(To be continued.)

Summary of Varieties of Fruits reported by Fruit Inspectors to be suitable for certain districts.

Inspector Stokes, Orange.

Parkes.

Apricots ... Early Moorpark and, possibly, Blenheim.
Peaches ... Elberta, Salwey, Princess Royal.
Pears ... Beurré Bosc, Packham's Triumph, Bartlett.
Plums .. Kelsey, Blood, Wickson, Diamond.
Grapes ... Gordo Blanco, Black Muscat.

Note.—At Mr. Sand's place, Parkes, there is a variety of grape grown known as "Hanne Poort," from South Africa. It is a red grape, splendid flavour, large bunches, large berries, but the market looks askance at red grapes.

Forbes.

Peaches ... All the standard varieties.
Apricots ... ,, ,,
Grapes ... Black Hamburgh, Black Muscat, Gordo, Black Princess.
Pears ... Beurré Bosc, Bartlett, Packham's Triumph, Keiffer's.

Note.—Any variety of grape can be grown at Forbes.

Cowra-Grenfell.

Apples ... Generally not a suitable place, but in some isolated instances may be grown. Granny Smith, Snowy, Carrington may possibly do, but, personally, would not favour apples.
Pears ... Beurré Bosc, Bartlett, Packham's Triumph.
Apricots . Moorpark (early), Camden.
Peaches ... All the standard varieties, Elberta, Salwey, Princess Royal, Italian Cling.
Plums ... President, Angelina Burdette, Blood, Diamond.
Grapes ... Black Muscat, Gordo Blanco, Black Prince.

Spring Hill, Milthorpe, Blayney, Newbridge, Bathurst.

Grapes ... Do fairly well at Spring Hill—that is, one or two varieties, Black Muscat and Black Prince possibly being the best.
Apples ... Granny Smith, Five Crown, Jonathan
Pears ... Beurré Bosc, Bartlett, Packham's Triumph, Keiffer's.
Plums ... Pond's Seedling, Golden Drop, Angelina Burdette.

Inspector Johnston, Young.

Young.

Peaches ... Brigg's Red May, Elberta.
Grapes ... Most varieties do well here.
Apples ... Northern Spy, Rome Beauty, Cox's Orange Pippin, Carpenter, Mobbs' Royal.
Pears ... Bartlett, Jargonelle.
Plums ... Most varieties do well here.
Apricots ... Moorpark ; subject to frost.

Murrumburrah and Demondrille.

Peaches ... Brigg's Red May, Elberta.
Apples ... Nelson, Five Crown, Winter Pearmain.
Plums .. October Purple, Satsuma, Blood.
Pears ... Bartlett.
Apricots ... Moorpark.
Grapes ... Most varieties do well here.

Koorawatha.

Peaches ... Elberta.
Apples ... Jonathan, Rome Beauty, Munro's Favourite, Winter Pearmain, Cleopatra.
Apricots ... Moorpark.
Plums ... Prunes, Diamond, Wickson, Bully, Orleans.
Pears ... Beurré Clairgeau, Bartlett.

Calabash.

Peaches ... Elberta, Late Italian, Royal George.
Apples ... Five Crown, Winter Pearmain, Jonathan.
Grapes ... Black Muscat, Black Prince, Muscat Alexandria.
Apricots ... Moorpark.
Plums ... Prunes, Diamond, Orleans.
Pears ... Bartlett.

Wombat.

Peaches ... Brigg's Red May, Elberta, Italian, Royal George Slipstone.
Apples ... Five Crown, Irish Peach, Jonathan.
Plums ... Blood Plum, October Purple.
Apricots ... Moorpark.
Pears ... Bartlett.
Grapes ... Black Muscat, White Alexandria (Muscat), Waltham Cross.

Tumut.

Peaches ... Briggs' Red May, Late Italian ; subject to frosts.
Apricots ... Moorpark.
Apples ... Gravenstein, Jonathan, Five Crown, Winter Pearmain.
Plums ... Satsuma, October Purple, Blood.
Pears ... Bartlett ; most varieties do well here.

Batlow.

Apples ... Five Crown, Adam's Pearmain, Jonathan.
Pears ... Bartlett, Winter Cole.
Plums ... Prunes, Angelina Burdette, Blood.

Binalong.

Peaches ... Briggs' Red May, Elberta.
Apples ... Five Crown, Jonathan, Winter Permain.

Tangmangaroo.

Peaches ... Elberta, Briggs' Red May.
Plums ... Most varieties do well here.
Pears ... Bartlett ; other varieties also do well.
Apples ... Five Crown, Cleopatra, Jonathan, Carpenter, Gravenstein, Buncombe.

Inspector NICHOLSON, Harris Park.

Parish of Wingello.

Apples ... Five Crown, Jonathan, Rome Beauty, Buncombe.

Inspector JONES, Bomaderry.

Darke's Forest, near Helensburgh.

Apples ... Shepherd's Perfection.

Mounts Keira and Kembla.

Apples ... Northern Spy, Five Crown, Rome Beauty, Jonathan, Carpenter.

Wollongong.

Apples ... Northern Spy, Rome Beauty, Five Crown, Carpenter, Jonathan.

Inspector BROOKS, Gosford.

Apples ... Allsop's Early, Smith's Early, Carrington, Granny Smith, Mobbs' Royal, Munroe's Favourite, Rome Beauty, Trivett's Seedling, Lord Nelson, Ourimbah Pippin.
Apricots ... Allen's Early, Early Moorpark.
Grapes ... Isabella, Black Hamburg.
Peaches ... Briggs' Red May, Early Crawford, Early Rivers, Elberta, Flat China, Gold Dust, Hale's Early, Royal George, Shanghai Seedling, Sneed Triumph.
Pears ... Bergamot, Beurré Bosc, China, Jargonelle, Bartlett.
Plums ... Blood, Burbank, Kelsey, Large Red Satsuma, Wickson, Climax.

Inspector ROUGHLEY, Bega.

Apples ... Granny Smith, Winter Pearmain, Northern Spy, Lord Nelson.
Apricots ... Early and late varieties seem to flourish alike.
Peaches ... Briggs' Red May, Italian Red, Elberta, Comet, Muir.
Pears ... Bartlett, Jargonelle, Bergamot, Windsor.
Plums ... Blood, Blue Diamond, Burbank.

Inspector SMITH, Singleton.

Apples ... Granny Smith, Gravenstein, Irish Peach, Jonathan, Rome Beauty, Five Crown Pippin.
Apricots ... Moorpark, Royal, Newcastle, Pineapple.
Pears ... Bartlett, China, Kieffer's Hybrid, Packham's Triumph, Bergamot d'Esperance, Williams' Bartlett.
Plums ... Wickson, Kelsey, Burbank, Angelina Burdette, Loutherborough.
Peaches ... Henrietta, Alexandria, Briggs' Red May, Devlin Red, Red Italian Cling, Sneed, Yellow Italian, Elberta.
Grapes ... Black Hamburg, Doradillo, Muscat of Alexandria, Muscat Hamburg, Black Muscat, Chasselas Blanc.

Inspector ARCHER, Corowa.

Apples ... Nick-a-Jack, Rokewood, Jonathan, Granny Smith, Five Crown Pippin, Rome Beauty, Shockley, Munro's Favourite, Delicious.
Apricots ... Ouillin's Early, Royal, Moorpark.
Grapes ... Most varieties, wine or table ; late varieties bring good prices.
Peaches ... Brigg's Red May, Foster, California, Lady Palmerston, Susquehana, Muir.
Pears ... Bartlett, Doyenne Boussock.
Plums ... Coe's Golden Drop, Orleans, Greengage, Yellow Egg, the Californian Prune especially adapted, Japanese, Satsuma, Wickson, Burbank.

Inspector CORRIE, Grafton.

Clarence River.

Apples ... Granny Smith, Carrington, Early Harvester, Ribstone Pippin.
Apricots ... Moorpark, Hemskirke.
Grapes ... Isabella (common), Early Sherry, Black Hamburg, Lady's Finger, Sweetwater.
Peaches ... Flat China, Shanghai, Italian Yellow (seedlings of all descriptions).
Pears ... China, Bartlett, Winter Cole.
Plums ... Greengage, Kelsey, Blood, Satsuma.

Inspector LANKESTER, Albury.

Apples ... Irish Peach, Stone Pippin, Prince Bismarck, Five Crown, Winter Majetin, Rome Beauty, Cleopatra.
Apricots ... Mansfield Seedling, Moorpark, St. Ambrose, Ouillin's Early.
Grapes ... Baxter's Sherry, Golden Hambro, Doradillo, Thompson's Pride, Chasselas Verdant, Royal Ascot, Basham, Mammoth, Barge Chilli Rose, Red Hanne Poort, Blue Imperial, Muscat Hamburgh, White Shiraz, Reisling, Verdeihlo, Shepherd's Reisling, Black Shiraz, Malbec, Burgundy, Mataro, Frontignac ; for raisins—Raisin des Dames, Gordo Blanco ; for currants—Zante.
Peaches ... Royal George, Brigg's Red May, Hale's Early.
Pears ... Bartlett, Marie Louise, Napoleon, Jargonelle.
Plums ... Magnum Bonum, Early Orleans, Greengage, Golden Drop.

Inspector HOWARD, Tamworth.

Apples ... Winter Permain, Trivett's Seedling, Five Crown, Lord Nelson, Peasegood Nonesuch, Granny Smith, Ribstone Pippin, Beauty of Bath, Adam Permain, Russet, Jonathan, Carrington.
Apricots ... Alsace, Camden, Early Moorpark, Hemskirke, Moorpark.
Grapes ... Black Hamburg, Muscatel, Late Sherry, Black Prince, Isabella, Black Spanish.
Pears ... Bergamot, China, Jargonelle, Bartlett, Winter Nelis, Windsor.
Plums ... Angelina Burdette, Coe's Late Red, Evans' Early, Greengage, Loutherborough, Satsuma, Burbank.

Inspector S. J. MOORE, jun., Castle Hill, Dural, Glenorie, Galston, and Arcadia Districts.

Oranges .. Parramatta, White Siletta, Late Valencia, Washington Navel.
Mandarins ... Emperor.
Lemons ... Lisbon.

And most leading varieties of Plums, Peaches, Nectarines, Apples, Pears, Persimmons, Quinces, and Grapes.

Soil Nitrogen.

The subject of soil nitrogen is one which now occupies a good deal of attention in agricultural circles, and in particular much attention is being devoted to the question of the bacteria of the root nodules of leguminous plants. Several commercial preparations are available, and, at the instance of this Department, the Government Bureau of Microbiology has isolated a series of bacteria from locally-grown plants.

The species available have been obtained from Broad, Butter, Dwarf, Lima, Madagascar, and Black Mauritius Beans; Garden and Sweet Peas, Common and Giant Cowpeas; Algerian and Common Lucerne; White Clover and Bird's foot trefoil; Lupinus arborica and Galega officinalis.

It is the intention of the Department to put the value of bacterial inoculation to a practical test, and the managers of the different Experiment Farms will be supplied with the cultures and instructed to make observations to determine their value.

The Director of the Bureau of Microbiology, and the Principal of the Hawkesbury Agricultural College, are now co-operating in conducting a series of scientific experiments upon various points still obscure as regards the best mode of preparation and use of the cultures.

Members of the community who desire to experiment can also be supplied with the preparations, but it is to be understood that the Department is not in a position to make any recommendations on the subject pending issue of the observations referred to above.

It might be added that it is within the power of nearly every farmer and fruit-grower to test for himself the importance of the addition of nitrogen to the soil. Without an adequate supply of available nitrogen in the soil, it is impossible to get maximum results in any single season, or to maintain the average fertility of the land over a series of seasons. If one has to purchase this indispensable ingredient in the form of sulphate of ammonia, dried blood, or bone-dust, it will be found to be a costly, although generally a highly reproductive, undertaking. But, in a climate like ours, nitrogenous manures have to be handled with greatest nicety, or most disappointing results may follow. It is only necessary to refer to the tabulated results of any series of experiments with fertilisers to see the truth of this. Under the circumstances, it can be understood that, if by the scientific investigation now proposed, simple means, such as the exact rotations of leguminous crops for our conditions—can be indicated to enable nitrogen collected from the atmosphere free of charge to be added automatically to the soil, which is also made easier to work and more retentive of moisture by the process to be recommended, then, indeed, will the cultivator have reached one of the easy places that lie so far apart along the road to continuous profitable farming.

And if any of our readers have any lingering doubts as to the real need and importance of scientific investigation of nitrification problems, they have only to attempt the growth, under ordinary field conditions, of an acre or two of field peas or other leguminous crop for the admittedly good purpose of green manuring, to realise how much one is at a loss to understand why more satisfactory results are not achieved.

Egg-laying Competitions at Hawkesbury Agricultural College and Experiment Farm.

D. S. THOMPSON, Poultry Expert.

THE seventh annual and second two years' egg-laying competitions organised by *The Daily Telegraph*, and conducted at the Hawkesbury Agricultural College by Mr. D. S. Thompson, Government Poultry Expert, concluded simultaneously on April 30.

The executive management was in the hands of a committee consisting of Messrs. W. S. Campbell (Director of Agriculture), H. W. Potts (Principal of the Hawkesbury College), D. S. Thompson, A. A. Dunnicliff, junior (*The Daily Telegraph*), and S. Ellis, J. Stewart, A. E. Henry, E. Waldron, and L. L. Ramsay (competitors' representatives). Liberal cash prizes were given, amounting to £110, and including £50 donated by *The Daily Telegraph.*

What the Competitions Teach.

The competitions just closed show what excellent results can be attained by concentration of effort. *The Daily Telegraph*, the Department of Agriculture, and the poultry breeders of this State have systematically raised the average production of eggs from 130 eggs per hen in the first competition to 180 in the seventh, or an advance of over 38½ per cent., and an equivalent in extra profits. Another important result achieved from the gradual raising of the minimum weight of eggs, to entitle competitors to participate in the prize money, to the commercial standard of 24 oz. per dozen, is that the strains laying undersized eggs have been eliminated. In the first annual test 22 per cent. of the pens did not lay eggs up to the market standard size, and the defaulters have gradually lessened, until there were none in the seventh competition. In other respects, too, year after year a general improvement in the birds has been noticeable. It is true that nothing succeeds like success, but nothing leads to success more than emulation. The data collected have been of great use to breeders everywhere, nevertheless it may be said that the value of egg-laying competitions has only just been fringed. Each year the lessons to be deduced become more reliable.

Weather Conditions.

The weather conditions of this year's competition, as well as of the three previous ones, have been mild, and with a very low rainfall. This has been in favour of egg production. The third competition was the only one of the series held under adverse conditions, and this was won by Silver Wyandottes. Since 1904 the conditions have been most favourable to White Leghorns; and although these have demonstrated their claim to the title of "queens of layers," yet the Silver Wyandotte and Black Orpington will be found their equals for a rainy day. We have had a run of dry years, and the White Leghorns have proved supreme. When the cycle of wet years returns, the Silver Wyandotte and Black Orpington will go far to divide honors with them.

Except the two days in January, when the glass rose to 117 deg. Fahr. in the shade, and we lost 40 hens from heat apoplexy, the weather was all that could be desired.

Mr. P. Lowe's White Leghorns.—First Prize—2,624 eggs. Holders of World's Record for 2 year test.

Member of Mr. R. Boardman's Pen—White Leghorns.—Second Prize—2,380 eggs.

THE TWO YEARS' TEST.

Hawkesbury Agricultural College.

Mrs. E. L. Snowden's White Leghorns.

First Prize—1,379 eggs.

SEVENTH ANNUAL TEST.

Mortality and Disease.

During the seven years there has been practically no disease amongst the 600 hens. This speaks well for the care of the breeders, and for the general health of the fowls of this State. The death-roll has been rather heavy, but two-thirds of this can be put down to unusual conditions. Thus 68 hens and pullets died during the past twelve months—42 pullets and 26 hens—of which number no less than 40 succumbed to the effects of the heat-wave in January. From ordinary causes, therefore, the mortality was less than 5 per cent., which is very much below the average.

Value of Breeds and Strains.

Any breed is as good as another was the general impression before these competitions were inaugurated ; but now that impression has been dispelled, at least amongst those who keep fowls for a livelihood. Now, take the White Leghorns and the modern Minorca. The latter, before these competitions were commenced, were bred everywhere in large numbers ; and because they laid a very large egg, which everybody could see, they were supposed to be deservedly popular ; in fact, plenty of people regarded them as champion layers. Now the other side has been exposed, the side the public could not see, because there were no definite data to go by. They have lost their popularity, and are not now bred by anyone who is farming for profit. Does this show that one breed is as good as another? It simply means that if these one-time popular fowls were kept in large numbers on a utility poultry farm, it would spell ruin in no time, while the same number of average White Leghorns would return the poultry farmer a reasonable living. The deficiencies of other breeds have likewise been demonstrated.

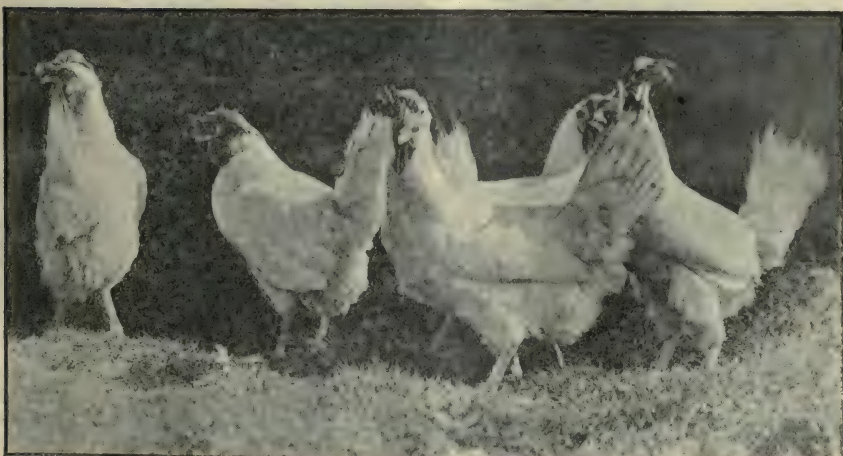
Types, Breeds, and Strains.

From the accumulated data the breeds have been fairly classified, so that it is much easier to-day than it was a few years ago for the intending poultry farmer to pick out a breed most likely to be profitable to him. Some strains have naturally proved better than others of the same breed, and much has been learned of type and conformity of structure for the best results in egg production. If breeders accept results as confirmed, and act on them—as very many have—a great benefit unquestionably accrues. The road that leads to success has been pointed out by actual results to the intending poultry farmer. These tests have narrowed down the best breeds to a small number. White Leghorns, Silver Wyandottes, Black Orpingtons, Buff Orpingtons, White Wyandottes, and Langshans is surely not a formidable list to choose from, when it is considered that previous to these tests the intending poultry-farmer was simply lost in bewilderment in turning his attention to any poultry book, to find the extraordinary varieties of fowls, all described as being of equal repute, with very little to choose between them. Many such misconceptions have been cleared away.

By delaying this report for a month I have been enabled to reproduce photographs of a number of the leading types of fowls in the competition. These will serve to convey a good idea of the points that the breeder must aim for.

Breeding for Stamina.

It must not be forgotten that, while great efforts are being made to increase the productiveness of pullets and keep up the marketable size of eggs, health and strength and general stamina are required to sustain life in the prodigious effort of putting out over 200 eggs for each hen for one year. The general mortality of the tests is practically all caused by ovarian weaknesses. Fortunately, those birds which succumb



Mr. S. Ell's' White Leghorns.

Second Prize—1,333 eggs.

SEVENTH ANNUAL TEST

cannot be bred from, but much more could be done by breeders ignoring a whole strain where great constitutional weakness has been proved. Bad-laying strains should not be perpetuated, and bad strains for ovarian weakness should not be bred from. The breeder should make a clean sweep of such, and resort to some strain proved not only to be prolific, but hardy and of great stamina and lasting powers.

Financial.

Throughout the last five years the price of foodstuffs has been almost prohibitory to poultry-farmers. These competitions have now run a complete cycle of years, and it has been a severe test in regard to showing profits in poultry-farming. The first test was run on an average fodder price of 2s. 10d., the second 2s. 5d., the third 1s. 6d., fourth 2s. 2d., fifth 2s., sixth 2s. 8d., and the seventh 3s. 1d. The third was the only one under normal prices, while the seventh was run under an abnormality of over 50 per cent. advance. The egg market certainly has been good, with advanced prices, but not to an extent corresponding with the higher rates for foodstuffs. To cope with a 50 per cent. advance in fodder the price of eggs should average 1s. 6d. per dozen for the year. The prices for staple foods throughout the past twelve months averaged as follow:—Wheat, 4s. 10d.; maize, 4s. 8d.; bran, 1s. 4d.; and pollard, 1s. 4d. per bushel. These figures form a record for the seven tests.

THE TWO YEARS' TEST.

Mr. P. Lowe's winning White Leghorns have established world's record for two years' laying by putting out 2,624 eggs, the previous best being 2,487, by Mr. J. R. Wakfer's Langshans, in the preceding test. The winners, too, achieved the remarkable average of over 191 eggs per hen in the second twelve months.

The Prize Winners.

The prize money amounted to £55 for the second year, and was won as follows:—

Greatest number of eggs in the two years:—

	£	s.	d.		£	s.	d.
1. P. Lowe	4	0	0	3. J. Jensen	2	0	0
2. R. Boardman...	3	0	0	4. Griffiths Bros.	1	0	0

Greatest number of eggs in second year:—

	£	s.	d.		£	s.	d.
1. P. Lowe, 1,150 eggs	5	0	0	4. Griffiths Bros., 939 eggs ...	2	0	0
2. R. Boardman, 1,029 eggs ...	3	0	0	5. F. Hopkins, 929 eggs ...	1	10	0
3. J. C. Gould, 1,010 eggs ...	2	10	0	6. J. Jensen, 914 eggs	1	0	0

Winter test, second year (April to July inclusive):—

	£	s.	d.		£	s.	d.
1. J. C. Gould, 395 eggs ...	2	10	0	3. E. Waldron, 208 eggs ...	1	0	0
2. Mrs. W. Sidwell, 269 eggs ...	2	0	0	4. D. Salter, 194 eggs	0	10	0

Market value of eggs for two years:—

	£	s.	d.		£	s.	d.
1. P. Lowe	3	0	0	3. J. C. Gould	1	10	0
2. R. Boardman...	2	0	0	4. J. Jensen	0	10	0

Mr. F. G. Brierley's White Leghorns.

Third Prize—1,830 eggs.

SEVENTH ANNUAL TEST.

Monthly prize of £1 for the highest total from a pen :—

April, P. Lowe	91 eggs	October, R. Boardman... ..	140 eggs
May, J. C. Gould	112 ,,	November, P. Lowe	145 ,,
June, J. C. Gould	112 ,,	December, R. Boardman ...	135 ,,
July, P. Lowe	112 ,,	January, P. Lowe	108 ,,
August, P. Lowe	128 ,,	February, L. S. Luck	93 ,,
September, Griffiths Bros. ...	133 ,,	March, P. Lowe	91 ,,

Champion prize of £5, or trophy value £5 (at winner's option), for the pen laying the most eggs in the two years without the replacement of a bird— P. Lowe.

Comparison of Results.

The following compares the results of the two competitions :—

	1st.	2nd.
Number of pens	40	50
Highest total, two years	2,487	2,624
Highest total, second year	1,054	1,150
Average per hen, first year	180	179
Average per hen, second year	124	127
Profit over feed per hen, first year	11/2	10/11
Profit over feed per hen, second year	6/0½	5/4¾
Greatest value of eggs, two years	£12/1/6	£12/16/9

The following compares the average number and value of eggs laid per hen by the different breeds during the first and second years respectively :—

Breed.	Eggs per Hen.		Value per Hen.	
	1st Year.	2nd Year.	1st Year.	2nd Year.
138 White Leghorns	195	137·4	19/2¾	13/0½
18 Minorcas	177	134·3	17/-	12/11
6 Andalusians...	165·8	145·1	16/-	13/11
36 Silver Wyandottes...	173·6	123·3	17/1½	13/6½
84 Black Orpingtons	172·4	110·8	17/-	11/9
6 Black Hamburgs	144·5	142·5	13/8½	14/-
6 Buff Leghorns	159·3	109	15/2½	10/3½
6 Brown Leghorns	152	95·6	14/6	8/9

The total cost of feeding the 300 old hens was—Bran and pollard, £33 ; grain, £63 ; meat, £2 ; green feed, £3 ; shell grit, £4 ; sundries, £1 : total, £106.

The total monthly laying in the second year was :—April, 1,393 eggs ; May, 830 ; June, 1,012 ; July, 2,151 ; August, 4,306 ; September, 5,391 ; October, 5,210 ; November, 5,025 ; December, 4,586 ; January, 3,193 ; February, 2,687 ; March, 2,324 ; grand total, 38,108.

The total net market value of the eggs laid was £186 16s 7d., from which deduct the cost of feed, £106, and a surplus of £80 16s. 7d. remains.

The appended table gives full details of the eggs laid, and the net market value from each pen of six hens. The figures in parentheses following competitors' names indicate the number of hens replaced during the two years.

Messrs. Craig Bros.' White Leghorns.

Fourth Prize—1,323 eggs

SEVENTH ANNUAL TEST.

EGGS laid, and net market value of the eggs from each pen of six hens.

Owner, Address, Breed.	First Year.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	January.	Feb.	March.	Total 2nd year.	Grand Total.	Weight per doz.	Total Market Value.
																oz.	
1. P. Lowe (0), Lower Portland : White Leghorns	1474	91	20	1	112	128	130	110	145	129	108	85	91	1150	2624	25	256/9
2. R. Boardman (1), Camden : White Leghorns	1351	31	0	28	74	120	123	140	136	135	84	77	81	1029	2380	27	234/5
3. J. Jensen (0), Sefton Park : White Leghorns	1302	39	27	37	79	111	120	115	103	73	70	70	65	914	2216	26	223/-
4. Griffiths Bros. (0), French's Forest : White Leghorns	1267	7	0	0	50	125	133	134	143	120	102	83	42	939	2206	24	210/4
5. L. S. Luck (2), Moruya : White Leghorns	1298	22	0	3	29	83	117	127	132	121	83	93	78	888	2183	26	216/2
6. W. E. Boutcher (1), Canterbury : White Leghorns	1245	2	19	19	60	97	125	138	129	121	72	65	46	893	2138	25	206/5
7. J. C. Gould (0), Wallsend : Silver Wyandottes	1125	77	112	112	94	111	95	95	71	47	73	54	71	1012	2135	28	228/4
8. A. F. Emmott (1), Moruya : White Leghorns	1218	7	0	20	63	88	130	132	131	118	70	78	53	890	2108	26	207/2
9. W. T. Ely (1), Rydalmere : Minorcas	1179	39	0	6	39	84	127	124	127	114	99	83	71	913	2092	23	203/5
10. Mrs. G. Atkinson (0), Belmore : White Leghorns	1322	17	0	0	26	85	120	118	125	88	69	68	46	762	2084	26	204/4
11. J. B. Littlewood (1), Milton : White Leghorns	1220	44	8	10	25	93	111	96	132	111	77	88	50	845	2065	26	205/-
12. F. Hopkins (2), Byron Bay : White Leghorns	1130	38	8	42	58	95	112	128	110	124	60	73	81	929	2059	24	211/-
13. Mrs. W. F. Hunt (0), Berowra : White Leghorns	1125	13	25	42	29	109	114	128	98	109	71	56	33	827	1952	27	188/9
14. Mrs. T. Partridge (2), Marrickville : White Leghorns	1074	45	0	0	8	87	123	130	131	124	98	89	40	875	1949	26	168/-
15. Johnson Bros. (1), Marsfield : White Leghorns	1148	0	0	10	33	88	122	126	112	112	93	69	33	798	1946	28	189/9
16. A. Arnold (0), Ashfield : White Leghorns	1247	50	6	30	30	79	86	88	73	93	64	54	44	697	1944	27	196/2
17. Mrs. A. M. Wilcock (2), Arncliffe : Black Orpingtons	1123	40	25	53	61	83	114	91	102	75	56	48	43	791	1914	26	186/9
18. J. Duncan (1), Wollongbar : White Leghorns	1123	21	0	21	83	86	115	108	100	93	63	56	28	774	1897	29	185/6
19. D. Darragh (2), Ashfield : White Leghorns	1059	11	0	7	27	90	112	127	138	121	83	74	47	837	1896	26	168/-
20. Wharepaka Yards (1), Wahroonga : White Leghorns	1210	10	0	10	21	92	129	137	121	100	28	0	24	672	1882	24	178/5
21. E. Waldron (1), Willoughby : Black Orpingtons	991	75	35	27	71	72	107	120	92	80	71	73	59	882	1873	28	187/3
22. W. J Napier (0), North Ryde : White Leghorns	1080	1	2	26	47	77	117	128	123	109	69	56	28	783	1863	25	183/1
23. Freeman Bros. (1), Five Dock : Minorcas	1060	34	19	19	73	95	113	115	104	78	65	38	55	808	1868	25	185/7
24. J. A. Salter (0), Camden : Andalusians	995	34	0	2	43	96	125	123	125	113	73	68	69	871	1866	29	179/6
25. W. Wills (2), St. Ives : Black Orpingtons	1112	19	22	31	14	77	103	119	110	83	74	47	52	751	1863	26	184/-
26. Mrs. W. Sidwell (0), Bowning : Silver Wyandottes	1074	21	66	81	77	104	102	73	81	64	49	16	41	775	1849	24	192/6
27. J. W. Woodland (3), Penrith : Black Hamburgs	967	50	11	10	67	105	100	91	95	100	77	73	76	855	1822	25	165/2
28. P. N. Walker (4), Emu Plains : White Leghorns	1131	34	29	26	36	61	66	68	74	77	83	78	57	689	1820	25	188/8
29. H. A. Doyle (2), Dulwich Hill : Black Orpingtons	1034	24	2	21	54	102	105	100	93	97	33	83	37	751	1785	26	172/3
30. E. A Thomas (0), Inverell : Black Orpingtons	1021	8	0	19	57	49	125	85	82	88	93	73	72	751	1772	26	171/5
31. A. J. Laraghy (0), Singleton : Silver Wyandottes	986	75.	44	34	18	73	100	88	82	77	66	54	63	774	1760	26	178/2
32. D. Salter (0), Wilberforce : Silver Wyandottes	1071	56	50	35	53	78	82	100	84	53	29	27	35	682	1753	26	179/8
33. S. J. W. Barron (2), Alstonville : White Leghorns	1046	0	0	0	34	89	121	128	108	120	68	25	8	701	1747	26	162/1
34. W. White (3), Stanmore : Black Orpingtons	1053	16	59	13	86	74	103	77	73	50	45	49	43	688	1741	25	180/2
35. Mrs. A. Page (1), Woollahra : Black Orpingtons	1007	37	66	30	72	82	78	71	71	65	58	46	57	733	1740	26	182/7
36. Mrs. Blacklow (3), Kogarah : Black Orpingtons	1036	46	8	29	54	119	88	72	75	85	35	34	52	697	1733	26	168/9
37. M. A. Vennard (0), Marsfield : White Leghorns	1009	18	0	0	1	101	126	128	115	96	44	41	30	690	1699	27	159/6
38. Cowan Bros. (1), Burwood : Black Orpingtons	1020	31	40	42	47	75	79	83	60	64	45	42	59	667	1687	28	177/7
39. T. Masters (1), Canley Vale : White Leghorns	934	15	8	20	16	62	129	125	113	111	70	31	14	714	1648	26	147/8
40. F. J. Wood (1), Ashfield : Minorcas	944	0	0	10	15	87	126	110	83	106	72	42	48	699	1643	26	149/9
41. A Creaser (2), Kogarah : Black Orpingtons	1162	20	0	11	14	63	86	90	64	44	37	25	15	469	1631	26	161/3
42. A. W. Duke (0), Nyngan : Black Orpingtons	1004	2	0	2	66	101	96	73	61	69	54	45	46	615	1619	26	155/5
43. J. Morgan (1), Port Kembla : Buff Leghorns	956	3	0	5	37	74	91	87	112	96	56	49	44	654	1610	25	152/1
44 N. B. Ralston (0), Fairfield : Silver Wyandottes	1001	23	20	5	2	92	102	86	82	82	55	39	18	606	1607	26	156/3
45. C. Jones, jun. (0), Rooty Hill : White Leghorns	907	13	0	0	0	79	139	139	134	130	47	5	3	680	1587	26	143/3
46. H. J. Hollier (0), Emu Plains : Silver Wyandottes	993	61	21	12	3	71	98	68	69	57	43	40	50	593	1586	26	158/5
47. Mrs. N. Williams (1), Abbotsford : Black Orpingtons	983	26	13	22	46	88	89	54	59	52	36	29	15	529	1512	29	154/-
48. J. Waugh (3), Kurri Kurri : Brown Leghorns	912	0	0	0	3	64	108	98	111	91	35	41	43	594	1506	26	139/8
49. J. Carroll (1), Belmore : Black Orpingtons	937	19	14	18	25	74	92	66	65	60	46	41	35	555	1492	27	146/-
50. H. A. Jones (1), Thornleigh : Black Orpingtons	1000	28	41	1	19	42	46	53	61	51	42	14	33	431	1431	26	144/4

Messrs. Bright and Thompson's White Leghorns.

Fifth Prize—1,312 eggs.

SEVENTH ANNUAL TEST.

SEVENTH ANNUAL TEST.

An eminently satisfactory feature in connection with the seventh annual test was that the average laying was the best of the whole series. The following compares the results of the seven competitions :—

	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.
Number of pens ...	38	70	100	100	100	60	50
Winning total	1,113	1,308	1,224	1,411	1,481	1,474	1,379
Lowest total	459	666	532	635	721	665	656
Highest month ...	137	160	154	168	162	161	159
Average per hen ...	130	163	152	166	171	173	180
Greatest value... ...	140/-	150/-	114/-	125/-	137/-	149/-	146/6
Average price eggs ...	1/1	1/3¾	1/-	/11½	1/0½	1/2¼	1/3¼
Average per hen ...	15/6	17/9½	12/9	13/3½	14/10	17/2	19 2
Feed, cost per hen ...	6/-	5/9¾	4/5½	5 3½	5/10	7/-	7/9½
Profit over feed ...	9/6	11/11¾	8/2½	8/-	9/-	10/2	11/4½

The analyses of the average production of, and the value of the eggs laid per hen by the various breeds are as follow :—

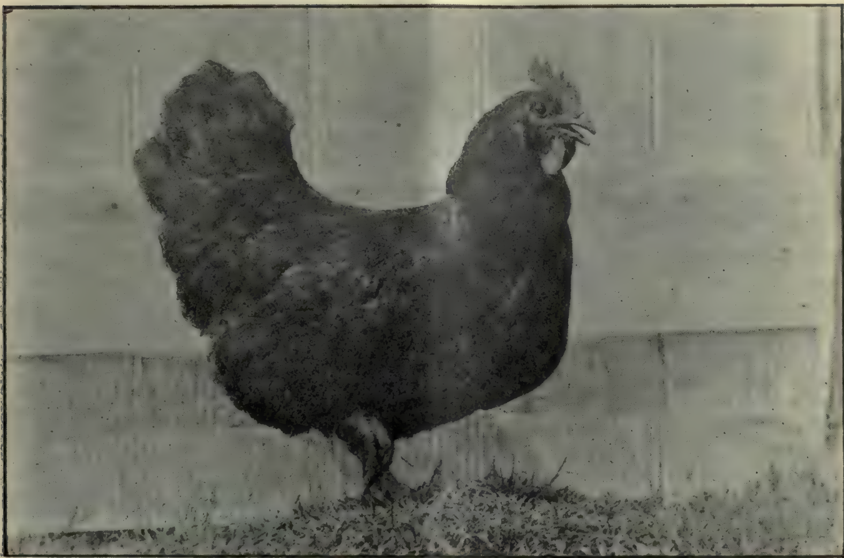
Breed.	Eggs per hen.	Value per hen.
114 White Leghorns	199·2	21/5½
6 Cuckoo Leghorns	193·6	20/9½
6 Brown Leghorns	189·5	21/2
36 Langshans	184·2	20/1
66 Black Orpingtons	177·1	18/9
42 Silver Wyandottes	170·5	18/2
6 Golden Wyandottes	128·6	12/11
24 White Orpingtons	115·6	11/8

The Prize List.

The prize money for the competition totalled £55, and was won as follows :—

Greatest number of eggs in the twelve months :—

	£	s.	d.
Mrs. E. L. Snowden (1) ...	5	0	0
S. Ellis (2)	4	0	0
F. J. Brierley (3)	3	0	0
Craig Bros. (4)	2	0	0
Bright and Thompson (5) ...	1	10	0
J. Kelly (6)	1	0	0
Mrs. E. Farrar (7)	1	0	0
J. Stewart (8)	1	0	0
F. Herps (9)	1	0	0
R. J. Hapgood (10)	0	10	0
A. E. Henry (11)	0	10	0
W. Frame (12)	0	10	0



Mr. J. Kelly's Black Orpingtons.

Sixth Prize—1,288 eggs. (First of other breeds).

First Prize, General Utility.

SEVENTH ANNUAL TEST.

Market value of eggs for the twelve months :—

	£	s.	d.
Mrs. E. L. Snowden (1) ...	3	0	0
S. Ellis (2)	2	0	0
F. J. Brierley (3)	1	0	0

Number of eggs first month (open to pens laying seventy eggs or more) :—

	£	s.	d.
J. R. Wakfer (90)	2	0	0
E. J. Winton (87)	1	0	0
F. J. Brierley (85)	0	10	0

Winter test (first four months) :—

	£	s.	d.
Forest Home Poultry Farm, 471 eggs (1)	4	0	0
J. Stewart, 389 eggs (2) ...	3	0	0
Bright and Thompson, 378 eggs (3)	2	0	0
S. Ellis, 376 eggs (4)	1	0	0

General utility (open to pens the hens n which averaged at least 6 lb. in weight at noon on March 1, 1909, decided by the number of eggs) :—

	£	s.	d.
J. Kelly, total weight of hens, 36 lb. (1)	2	0	0
A. E. Henry, 37 lb. (2)... ..	1	0	0
Mrs. E. Scaysbrook, 36½ lb. (3)	0	10	0

Monthly prize of £1 for the greatest number of eggs from a pen, April excepted :—

May, Forest Home Poultry Farm	131 eggs
June, J. Kelly	134 ,,
July, Mrs. E. Scaysbrook ...	152 ,,
August, Mrs. E. Scaysbrook...	159 ,,
September, Mrs. E. Scaysbrook	154 ,,
October, F. J. Brierley ...	155 eggs
November, F. J. Brierley ...	146 ,,
December, W. Frame... ...	140 ,,
January, F. J. Brierley ...	131 ,,
February, A. E. Cooke ...	116 ,,
March, Mrs. E. L. Snowden...	109 ,,

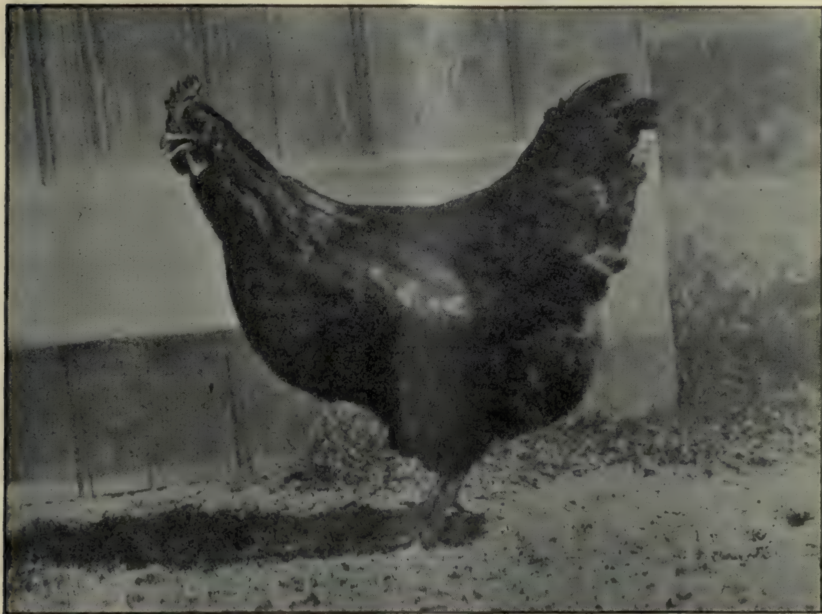
Financial Result and Records.

The total cost for the 300 pullets was—Bran and pollard, £40 ; grain, £65 ; meat, £3 ; green feed, £4 ; shell grit, £4 ; sundries, £1 ; total, £117.

The total monthly laying was—April, 1,415 eggs ; May, 3,205 ; June, 4,413 ; July, 5,194 ; August, 6,311 ; September, 6,256 ; October, 6,040 ; November, 5,371 ; December, 4,937 ; January, 4,126 ; February, 3,434 ; March, 3,398 ; grand total, 54,070.

The net total market value of the eggs laid was £287 16s. If the cost of feeding, £117, is deducted, a surplus of £170 16s. remains.

The appended table gives full details of the eggs laid and the net market value of the eggs from each pen of six hens, the replacements of birds being indicated by the figures in parentheses after competitors' names.



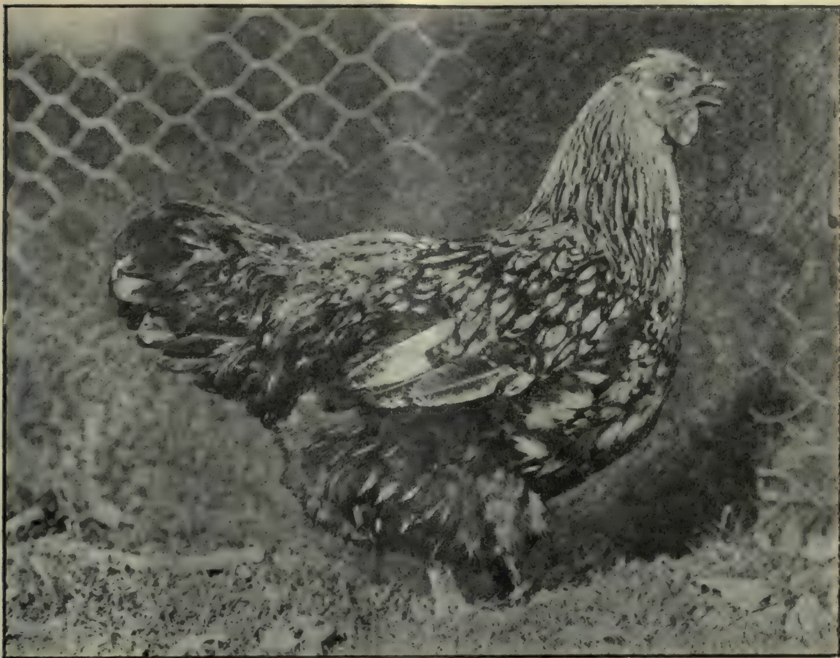
The Forest Home Poultry Farm, Langshans.

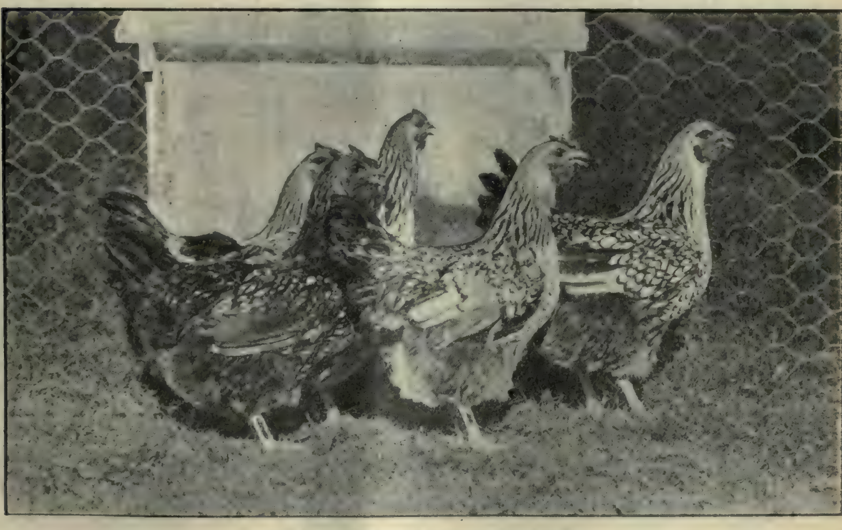
First Prize, Winter Test (4 months—471 eggs), and second in other breeds.

SEVENTH ANNUAL TEST.

EGGS laid, and net market value of the eggs from each hen.

Owner, Address, Breed.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	January.	Feb.	March.	Total.	Weight per doz.	Market Value.
														oz.	
1. Mrs. E. L. Snowden (1), Guildford : White Leghorns	31	73	127	114	138	151	150	142	133	101	110	109	1379	24	146/6
2. S. Ellis (0), Botany : White Leghorns	73	112	94	97	119	146	134	126	124	110	106	92	1333	27	145/6
3. F. J. Brierley (0), Carlingford : White Leghorns	85	84	38	82	140	146	155	146	128	131	99	96	1330	25	140/6
4. Craig Bros. (0), Black Forest (S.A.) : White Leghorns	37	68	78	119	148	149	147	142	123	128	98	86	1323	26	137/9
5. Bright and Thompson (1), Dulwich Hill : White Leghorns	47	90	108	133	136	151	137	124	132	113	72	69	1312	25	131/7
6. J. Kelly (1), Gore Hill : Black Orpingtons	7	73	134	136	147	144	123	121	125	91	91	96	1288	24½	136/-
7. Mrs. E. Farrar (0), Liverpool : White Leghorns	21	101	104	98	131	141	146	129	138	107	79	67	1268	25	133/9
8. J. Stewart (0), Berowra : White Leghorns	53	113	98	125	135	126	139	119	99	86	93	71	1257	25½	137/-
9. F. Herps (1), Lower Portland : Black Orpingtons	30	89	130	120	142	132	124	112	101	86	83	96	1248	24	131/8
10. R. J. Hapgood (0), Tilba Tilba : White Leghorns	14	61	101	113	132	146	148	134	113	110	95	66	1233	28	127/5
11. A. E. Henry (0), Ryde : Black Orpingtons	72	71	104	120	120	140	143	98	86	102	87	87	1230	26	134/-
12. W. Frame (1), Canterbury : White Leghorns	67	101	94	96	117	144	144	129	140	95	62	39	1228	26	130/8
13. Mrs. E. Scaysbrook (0), Gosford . Black Orpingtons	17	44	105	152	159	154	130	121	101	71	91	76	1221	24½	124/4
14. A. H. Padman (1), Adelaide (S.A.) : White Leghorns	53	85	89	102	129	143	130	122	133	100	78	39	1203	24	127/1
15. J. C. Harris (0), Tamworth : White Leghorns	36	67	110	113	120	141	139	118	119	99	74	62	1198	25	116/2
16. Mrs. A. D. Craig (0), Baulkham Hills : White Leghorns	33	76	96	119	130	138	148	141	99	77	58	78	1193	25½	127/3
17. Forest Home Poultry Farm (2), Adamstown : Langshans	81	131	117	142	139	96	89	99	67	64	89	79	1192	25½	138/8
18. W. Mitchell (0), North Ryde : Cuckoo Leghorns	42	81	117	86	128	118	126	113	115	77	63	96	1162	26½	124/9
19. J. R. Wakfer ( ), Chatswood : Langshans	90	33	118	89	89	133	116	105	102	90	71	102	1138	26	124/9
20. A. E. Cooke (1), Colo Vale : Brown Leghorns	57	69	19	45	122	142	144	123	116	106	116	78	1137	24½	127/1
21. A. O. Weynton (0), Willoughby : White Leghorns	10	103	87	94	129	135	121	132	111	95	67	46	1130	28	119/2
22. E. J. Winton (1), Nowra : Langshans	87	66	70	93	126	127	119	111	98	88	70	73	1128	26	121/5
23. W. Whiteoak (1), Parramatta : Langshans	19	60	83	128	130	125	103	105	95	95	89	94	1126	26	119/1
24. H. Ellis (1), Kellyville : White Leghorns	26	44	89	96	128	142	148	141	120	96	61	19	1110	24	113/6
25. W. H. Forsyth (0), Willoughby : White Leghorns	4	36	58	122	138	141	144	133	133	91	68	38	1106	26½	109/-
26. S. Wade, jun. (1), Tamworth : Silver Wyandottes	19	54	109	124	137	117	123	84	89	79	77	93	1105	26	117/7
27. L. A. Herdegen (0), Eastern Creek : Silver Wyandottes	52	102	104	103	132	103	115	90	87	77	60	77	1102	24	121/8
28. S. A. Gordon (2), St. Ives : Langshans	9	71	107	108	144	128	112	88	72	95	66	90	1090	26	115/9
29. S. Gordon (1), St. Ives : Black Orpingtons	5	84	105	122	150	126	115	94	103	67	62	51	1084	24	116/1
30. L. H. Coates (2), Glenbrook : Black Orpingtons	2	44	126	126	121	138	125	111	90	75	62	64	1084	26½	112/7
31. J. O. Smith (0), St. Peters : White Leghorns	0	50	80	108	129	134	134	94	111	88	79	73	1080	24½	110/4
32. C. L. Simon (1), Moruya : White Leghorns	24	101	108	112	131	114	102	96	97	64	58	45	1052	26	113/-
33. Robbins and Alexander (2), Galston : Silver Wyandottes	30	104	121	107	123	105	79	77	84	66	68	80	1044	24	110/3
34. H. Rudd (0), Narellan : Silver Wyandottes	0	49	75	131	140	102	122	102	92	75	68	80	1036	24	107/1
35. R. J. Stuart (1), Blacktown : White Leghorns	0	0	20	107	131	133	143	123	130	96	75	68	1026	24	98/4
36. H. Fleming (6), Willoughby : Black Orpingtons	3	81	108	97	127	117	97	115	88	82	35	69	1022	26½	109/-
37. R. E. Warren (2), Glenfield : Silver Wyandottes	81	81	93	72	113	101	105	87	69	76	76	43	997	24	111/-
38. R. C. Fletcher (1), Guildford : Silver Wyandottes	4	89	102	105	110	96	104	79	76	73	58	83	979	24½	106/5
39. C. Poole (0), Leichhardt : Langshans	43	53	103	88	109	113	115	81	77	65	49	63	[illegible]	25	103/9
40. W. C. Cox (1), Canterbury : White Leghorns	13	62	74	96	114	118	128	115	105	54	33	37	949	26½	96/8
41. H. E. Kelly (3), Ashfield : Black Orpingtons	1	44	48	112	128	115	108	103	93	61	41	59	913	25	91/7
42. L. L. Ramsay (0), Carlingford : Black Orpingtons	0	33	105	111	122	105	89	82	59	65	69	69	909	28	95/7
43. J. A. Baird (3), Northwood : Black Orpingtons	28	17	79	118	92	106	103	112	77	74	50	43	899	24	93/-
44. D. B. Kirk (0), Merrylands : Silver Wyandottes	0	0	27	78	139	142	124	104	65	71	73	74	897	24	84/-
45. W. H. Jones (0), Bondi : Black Orpingtons	9	36	38	52	123	123	94	92	85	56	41	43	792	27½	77/9
46. W. Brown (0), Gladstone : Golden Wyandottes	0	23	66	95	133	105	82	73	55	59	24	57	772	27½	77/8
47. Mrs. H. Small (0), Chatswood : White Orpingtons	0	42	54	91	78	86	91	70	74	58	40	66	750	25	78/-
48. R. H. Turner (1), Berowra : White Orpingtons	0	4	70	71	74	100	91	79	71	48	43	38	689	26½	68/2
49. Mrs. C. A. Cannon (0), Epping : White Orpingtons	0	43	45	47	103	85	79	76	68	55	27	53	681	24	65/9
50. C. J. Hedges (2), Stanmore : White Orpingtons	0	1	38	89	133	93	84	58	66	38	30	26	656	26½	65/6





Mr. L. A. Herdegen's Silver Wyandottes.

Leading Pen of this breed.

SEVENTH ANNUAL TEST

Green Feeding of Poultry.

D. S. THOMPSON, Poultry Expert, Hawkesbury Agricultural College.

THE green feeding of poultry is a subject of the greatest importance. A few years ago it was not heard of. To-day it is only practised amongst the most skilled poultrymen.

The general farmer, the man who can produce the green feed, rarely thinks of it, and never practises the feeding. If he lives in a wheat district, the fowls are fed on wheat only ; if in maize country, he uses that grain alone. The up-to-date poultry farmer who buys his own food supplies, purchases green feeds or their substitutes, besides the grains and mill offal necessary.

It has now been demonstrated that a very large quantity of green fodder, produced on the farm, can be profitably fed to poultry. It has generally been understood that poultry, hens included, pecked grass and lived to a considerable extent by grazing on the pastures ; but when the green and succulent grass is nipped with frost in the winter or scorched in the summer, (both happen here at Richmond), the hen ceases from pecking, and stops laying. Of course, other artificial conditions are necessary in the way of meat feeding to take the place of insect life, and turn autumn and winter conditions into as near summer as possible, and equally, if not more so, is provision of green food. This is one of the great secrets of how to produce eggs in the autumn and winter, which is very valuable to the farmer, but it is also of great importance for him to know that he can feed with advantage so much valuable bulk fodder to his fowls at such a low productive cost.

The question is constantly asked: What are the best green foods for poultry? Lucerne is certainly the best, and if the land will not grow it, try rape. All green foods should be finely chaffed, the finer the better, and the more relished by the hens.

Lucerne.

Lucerne is a very useful crop for the poultry farmer who has suitable soil to grow it on. It is really astonishing how much green stuff can be obtained from a small patch of lucerne. The great thing is to confine the area to just the size that can be thoroughly prepared by very deep digging or forking, and unless the natural drainage is very good, artificially drained. A patch of lucerne, 15 feet square, properly sown and established, will suffice for a hundred head of poultry.

For poultry it should be as leafy as possible, and cut before it grows too long in the stem or hardens. It can be cut with an ordinary clover cutter or chaffed. A fairly large quantity can be cut at a time, and fed as required.

There have been comparisons made frequently between clover and lucerne. Both are good for poultry feeding; but lucerne, when once established, is perennial and can be cut repeatedly in the year, while clover will last but two years at most and can be cut once or twice only.

A comparison of the feeding value of lucerne and bran shows that the former is almost equal to that generally expensive mill product, which it can replace as the bulk ration of a concentrated mash.

	Protein.	Carbo-hydrates.	Fat.
Wheat Bran	15·4	53·9	4·0
Lucerne Chaff	14·3	42·7	2·2

But while the analysis of bran will be invariably found very close to these figures, lucerne has been known to contain even higher nutriment than bran. Plenty of green lucerne fed throughout the autumn will keep down chicken-pox.

Where lucerne cannot be grown, it can usually be purchased for less than bran, bulk for bulk. If purchased as dry chaff, if steeped in warm water and allowed to stand overnight, it turns almost as soft and green as when freshly cut. But if lucerne hay or chaff is used, care must be taken to see that it is well saved and leafy. The harsh, stalky, badly-saved hay sometimes put on the market would be useless.

The next in importance as a poultry food is clover, but it cannot be grown in the same quantities as lucerne, and usually only in cool climates.

Rape.

Rape is a first-class green food for poultry, and grows freely in most districts. Poultry are very fond of it, and while it is not of nearly so much feeding value as lucerne, it makes the best of alteratives and correctives which can be fed to laying hens. There is no need to dose them with Epsom salts if they are fed with plenty of rape. It is broad leafed (like the leaves of a cauliflower), and should be cut up as fine as possible to save waste.

Other Green Foods.

Other green foods of less value from a poultry point of view, but very serviceable in lieu of something better, are green oats, young maize plants, or amber cane, which require to be cut up as fine as possible and boiled well before being mixed with the mash. "Fat Hen," a common weed, makes a good green feed as a substitute for something better. In fact, fowls denied natural green stuff will eat anything which is green.

Below is given a table of the most important green fodders. Following that a table of root crops, but it will be found in theory what we have discovered in practice, that root crops are not of much value as a poultry food :—

TABLE I.—Green Foods.

	Protein.	Fat.	Carbo-hydrates.	Ash.	Indigestible Fibre.	Water.
Lucerne chaff ...	14·30	2·20	42·70	7·40	25·00	8·40
Lucerne, Green ...	4·80	0·60	8·00	2·70	7·40	71·80
Rape	2·30	0·50	8·40	2·00	2·60	84·50
Fat hen	6·51	0·69	5·86	3·06	3·06	81·71
Barley germ ...	27·6	3·0	47·1	6·4	10·9	5·0

TABLE II.—Root Crops.

	Protein.	Fat.	Carbo-hydrates.	Ash.	Water.
Parsnips	1·6	0·2	11·2	0 7	88·3
Mangolds	1·4	0·2	6 4	1·1	90·9
Sugar beet	1·8	0·1	10·7	0·9	86·5
Turnips...	0·9	0·1	8·2	0·7	88 6
Potatoes	0·9	0·3	15·6	1·0	78·9

Seasonable Notes.

Hawkesbury District.

H. W. POTTS, Principal, Hawkesbury Agricultural College.

THE weather continues dry and discouraging. The rainfall from the 1st of January has only reached 8½ inches. The frosts have set in early, and we are confronting a harsh, cold winter with inadequate supplies of moisture in the soil. However, as I write a welcome change is occurring, and it looks as if we will have a share in the good downfall which many districts are having. Those who were enterprising enough to take advantage of the rains in summer, and put in crops of maize and sorghums, are reaping the advantage of forage for stall feeding. The usual late winter and early spring fodders will be stunted and scarce.

The Value of Sorghum.

The sorghums this season have afforded fairly heavy yields, and are now providing nourishing and juicy food for horses, cattle, and pigs. Fortunately, this plant is hardy in early winter, and, unlike maize, resists the early frosts. It is also useful to cut and stook to dry as hay, possessing the advantage of drying well and resisting the softening influences of rains better than most crops in the stook.

Experience shows that stock relish this class of fodder when chaffed and mixed with lucerne for stall feeding.

The sorghums also provide excellent material to conserve as silage, either in the stack, pit, or tub. The silage of chaffed sorghum in the tub silo is unquestionably the most economical and appetising.

Maize.

The late-sown maize crops suffered severely with the early frost of last month. In the matured crops pulling has been carried on for some time. The maize stalks should not be wasted, as they form a useful, if rough, fodder. The American system of cutting stalks with the cob, and passing them through the shredder, deserves more attention at the hands of our maize growers.

The cob is harvested and the stalk shredded and stacked as stover. In winter this affords good roughage for the cows. In the absence of a shredder, the stalks can be chaffed and fed with other fodders suitably blended to form a balanced ration. In the face of a hard winter it is advisable to save all this class of food.

Wheat.

In connection with the growth of wheat, oats, and barley in this district, special attention should be paid to the question of suitable fertilisers. At page 466 of this issue will be found some results of experiments now

in progress here to determine the most effective and economical methods of manuring for these crops. It will be noted that last season the application of a few shillings' worth of superphosphate per acre proved very profitable.

The first sowings may be made as early as possible. It will be advisable to select quickly-maturing varieties, such as Thew, Bobs, or Steinwedel.

Oats.

The sowing of the main crops are to be completed this month. It will be well to continue sowing Algerian and Amarillo varieties. Coarser-growing sorts may also be recommended, such as Tartar King, Red Rust-proof, White Tartarian, Peerless White, Bonanza, Danish Island, and Abundance.

Barley.

The hardy varieties, known as Cape, will be the safest cropper under existing conditions, and with it may be sown peas. Early green fodder for spring is to be aimed at, and will be useful provided we are fortunate enough to secure the winter rains.

Rye.

This hardy and vigorous cereal is worth more than our usual care. It resists dry conditions, and the outlook points to the wisdom of sowing a further crop this month. Emerald or Thousandfold are the best varieties for this district.

Turnips, Swedes, Field Cabbage, Kale, Tree Kale, Kohl-rabi.

These crops will need some attention now. Thorough cultivation between the rows is needed to conserve moisture. The plants ought to be thinned out freely, allowing each plant adequate space for development.

Rape.

The last sowing of the season may be made, and given sufficient moisture, this valuable crop will be ready for use in from eight to ten weeks, and forms an excellent crop for grazing sheep or pigs. No better catch crop can be sown on land intended for the summer crops of maize, millets, or sorghums.

Onions.

Where onions are to be transplanted, now is the time to prepare the area in which they are to be set out. The soil must be thoroughly worked to bring it to fine, firm tilth. For this crop a loamy soil should be selected in a situation exposed to the sun. Onions thrive better on ridges than on the flat.

Where it is not possible to enrich the soil with well-decayed farmyard manure, use the following :—

Superphosphate	2 cwt.
Sulphate of potash	1 ,,
Dried blood	$\frac{3}{4}$,,

to the acre.

Plant out in rows 2 feet apart, with 6 inches between each plant.

Keep the weeds down by continual scarification of the soil.

Artichokes.

These relishable tubers are now available for the table and for pigs. They can be dug daily for domestic use, and can be kept in the ground until August.

Where they are intended for pigs, a small area should be hurdled off, and sows whose litters have just been weaned may be turned in to harvest the tubers. Sows in low condition as a result of rearing litters during the hot weather are thus afforded a class of fodder which has a well-deserved reputation for rapidly restoring vitality and flesh.

Sweet Potatoes

Are now ready for use. The tops, although frosted and decayed, should not be removed. They afford protection to the tubers below against the action of frost. When the tubers get frost-bitten they develop an objectionable flavour. They can now be dug as required, either for stock or domestic use.

In our soils no root crop pays so well as that of the sweet potato. This season the average yield here is 15 tons to the acre.

Efforts are often made to preserve sweet potatoes above ground, but with the exception of placing them in dry sand, most of the methods have failed. It is the best course to let them lie in the ground, and dig them as they are required, for the next six or eight weeks.

Pumpkins and Squashes.

Excellent crops were secured during the autumn, and in many places we still see them lying in the paddocks, where they are certain to go bad shortly. They should be brought under cover, and kept on cool, dry, well-ventilated floors, with straw or dry grass to rest on. All pumpkins should be carefully handled, otherwise decay quickly supervenes on any bruised surface. Place them in layers in such a way that every one may be easily accessible for periodical inspection. Whenever one is found rotting, it should be removed in order to prevent it affecting the others.

One cannot too highly recommend these valuable crops as substitutes for grass and other succulent food. Horses, cattle, sheep, and pigs all appreciate them and thrive well on this class of food.

Shade and Shelter Trees, Shrubs and Hedges.

We are continually faced with the fact that in order to occupy agricultural lands quickly, all native timbers are ruthlessly destroyed, and little or no provision is thought of for shade or shelter.

It means that we have to replace the timber to provide suitable shelter belts for stock for summer and winter.

The best time to arrange systematic planting is this month, and the following are useful trees. I have added the botanical names, because in some cases there is great confusion as to the identity of the trees and shrubs through the use of several common names being applied to the one plant:—

Pinus insignis	Remarkable pine.
,, *halepensis*	Aleppo pine.
,, *Benthamiana*	Bentham's pine.
,, *Canariensis*	Canary pine.
,, *excelsis*	Lofty pine.
,, *pinea*	House pine.
Auracaria Bidwilli	Bunya bunya.
,, *Cunninghami.*	
Cedrus deodora	American cedars.
,, *atlantica*	American cedars.
Cryptomaria elegans.	
,, *Japonica.*	
Cupressus Lawsoniana.	Cypress pines.
,, *pendula.*	Cypress pines.
,, *macrocarpa.*	Cypress pines.
,, *excelsis.*	Cypress pines.
,, *Lambertiana.*	Cypress pines.
Juniper virginica.	Junipers.
,, *Bermudiana.*	Junipers.
,, *macrocarpa.*	Junipers.
Camphora officinalis	Camphor tree.
Gleditshia tricanthos	Honey locust.
Grevillea robusta	Silky oak.
Melia azederach	White cedar.
Schinus molle	Pepper tree.
Platanus orientalis	Plane tree.
Quercus pedunculata	British oak.
Ceratonia siliqua	Carob bean.
Sterculia diversifolia	Kurrajong tree.

Amongst the hedges, the following have been found successful in this district:—

Ligustrum lucidem	Large-leaf Japanese privet.
,, *pubescens*	Small-leaf Japanese privet.
,, *Chinensis.*	
Gleditshia tricanthos	Honey locust.

How to Plant.

All trees for ornamental or avenue purposes may be planted 25 feet apart, but if required for shading or sheltering stock, 10 feet apart.

Holes should be excavated 2 feet deep and 4 feet across, and filled in with a mixture of well-rotted stable manure and soil. When planting, avoid placing the delicate roots directly on the manure. See that they are well surrounded and packed with soil. Saturate the mass with water, and cover finally with a layer of dry soil. The roots must be well tramped and packed before adding the water and final layer of soil.

Riverina.

G. M. McKEOWN, Manager, Wagga Experiment Farm.

Wheat.—June is regarded as rather late for sowing wheat; but as weather conditions sometimes cause an inevitable delay in farm work, such sowing as is not finished should be carried out with as little delay as possible, as every week lost in sowing later than the first week in the month will seriously affect the grain yield. The earliest varieties only should be sown.

Barley.—A final sowing for green fodder only may be made.

As the weather is too cold for sowing any seed but cereals, the work of the month will consist of ploughing and preparation of land to receive all possible moisture for the following crops, which should be sown in the months set opposite each, viz.:—

Lucerne.—August to middle of September.

Sheep's burnet.— ,, ,,

Sorghum.—Middle September to end of October.

Maize.— ,, ,,

Pumpkins, Melons, and Cucumbers.—Middle September to end of October.

Millets.—September and October.

Vegetables.—All growing crops, such as cabbage, cauliflowers, peas, beans, carrots, and parsnips, should be well tilled by means of horse or hand Planet Junior hoe.

THE PIG INDUSTRY IN INLAND DISTRICTS.

THE raising of pigs, which in most inland parts of this State is a comparatively neglected industry, is one of our most profitable branches of stock raising, and one which should receive far more attention than is bestowed on it.

In many parts of our hill country, where natural watercourses are fairly frequently met with, the conditions are more favourable than is the case in the lower parts of the districts concerned, as a plentiful supply of water is necessary, and running water is, naturally, preferable to that from any other source which cannot readily be frequently renewed. In the summer, in addition to a good supply of water for drinking, the pigs should also have access to water for bathing, as, otherwise, they would suffer in times of excessive heat.

On the Experiment Farm, the breeds which have been kept consist of the Large Yorkshire, the Small Yorkshire and the Berkshire. The two former are not likely to become popular, but the Berkshire has proved itself hardy and easily kept, and is much in favour with all who pay attention to the maintenance of quality in their stock, and who regard the matter of pig-keeping with an eye to the most profitable results.

A large proportion of the pigs in the district are of very inferior type, it being difficult to identify in them the leading characteristics of any special breed, they being chiefly the results of inbreeding, or breeding from immature or badly developed stock.

The Boar.

As with all other live stock, the use of a pure sire only is to be recommended, and, probably, no breed is more capable of transmitting his characteristics to his progeny than the Berkshire.

Whatever breed, however, is selected, the sire should be as typical as possible of that breed, possessing its best characteristics.

A shape indicating vigour of constitution with good fattening tendencies should be selected; show points, such as markings, being a matter of minor importance.

He should not be used for breeding before he is nine months old, and then only for a limited service. From twelve months upwards he may be more extensively used.

He should not be allowed to run with the herd, but should be kept apart in a fairly roomy run and fed, so as to keep him in good working condition, care being taken to prevent him from becoming fat.

Sows should be taken to the boar for service, and they should be removed as soon as they have been properly served.

The Sow.

In selecting sows, care should be taken that they are as typical as possible of their breed, and that they possess the full number of teats, viz., twelve, so as to ensure the full feeding capacity for large litters of young ones.

It is undesirable to breed from sows under one year old, unless in cases of especially good development.

Until within a week of farrowing, brood sows should be allowed as large a run as possible, with access to green pasture where practicable. They should then be confined in proper breeding pens apart from all other stock. In all seasons bedding consisting of short straw should be provided, and each pen should have battens secured to the wall posts at a sufficient distance above the floor, to enable the young pigs to escape the risk of being overlain by the mother. As the young pigs increase in size, the quantity of bedding may be increased. An ample supply of water should be provided.

During the first few days, food which has a heating tendency, such as whole grain, should be avoided; but later, she may be freely fed with pollard, well crushed and boiled grain, kitchen refuse also cooked, and such succulent green fodder as may be available. This is necessary to compensate for the heavy drain on her system, caused by the necessity for providing for her young ones, and, at the same time, maintaining her own vigour, as it is undesirable that her own condition should deteriorate.

As the young pigs reach an age at which they partly feed themselves, the quantity of food should be increased to meet the requirements of the larger number, and if the pens are so placed as to allow of access to a grazing area it will be of great advantage to the growing stock. Our usual practice is to allow sows to suckle their young ones until they are 9 or 10 weeks old, although they may be safely weaned at 8 weeks. The extra period of suckling, however, is of considerable advantage to young stock.

We have bred profitable litters from sows up to 7 years old, and even later, good results may be obtained. It is, however, usually desirable to fatten them for sale before that age is reached.

During the winter and until about November, at the Wagga Farm, it is found possible to provide artificial pasture for pigs, by sowing Dwarf Essex rape, barley, and lucerne in small separate areas, which are grazed in succession as they become available, the pigs being allowed to return to their sleeping quarters at will. Either crop may be divided into sections, if so desired, by means of hurdles, and portable houses for sleeping quarters may be provided where the crops cannot be sown so close to the main yards as to be of easy access. When thus pastured, one feed of grain is given each day, instead of two or three, as is usual when no pasture is available. The grain ration in the latter case ranges up to about 5 lb. per day, according to the size and age of the animal.

Housing

For brood sows the houses should be enclosed on three sides, the open side being that which is not exposed to the most prevalent wind. For ordinary stock, houses with low eaves, about 3 feet from the ground, have been found to meet climatic requirements, as they are cool in summer, and in winter they are made snug by filling them with straw, the supply of which is frequently renewed.

The strict observation of cleanliness in all departments will prove the best preventive of disease; but when purchasing stock care should be taken that they are procured from clean healthy herds.

If stock suffer from the attacks of lice, a remedy will be found in a dip composed of 2 lb. of Quibell's sheep dip in 100 lb. of water.

The sleeping place should also be well sprayed with the liquid at intervals during the summer.

Preparing Pork and Bacon for Home Use.*

It is necessary to give the greatest care to the preparation of the pig and to the curing of the product, in order to secure a uniformly good article of food Before slaughtering, the pig should be in perfect health and in that condition of flesh that will make a good quality of meat when dressed. An animal to furnish good meat should be gaining right up to the time of slaughtering. The care just previous to slaughtering is quite important. It is not a good plan to kill an animal while on full feed. It should be off feed at least twenty-four to thirty-six hours, but should have all the water it will drink. The slaughtering should be quickly and neatly done, and the dressing should also be neatly done, care being used to remove all scurf and hair, if possible. The temperature of the scalding water should be 180 to 185 degrees F. This will insure a scald that will allow the hair being pulled out by the roots, which is very much preferable to shaving it off and leaving the hair roots and a portion of the bristles in the skin.

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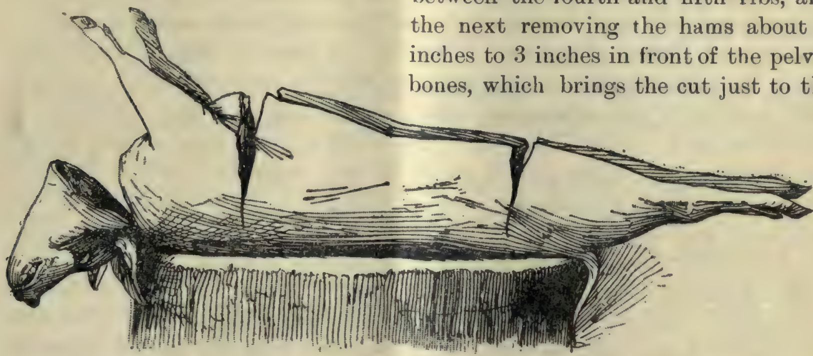
* The following method was republished from the *American Agriculturist* in 1903, and I have found it answer all requirements under our conditions.

How to Cut Up a Pig.

The accompanying illustration shows a convenient method of cutting, and one which is well adapted to farm use. It will be noted that three cross sections of the hog are made: one removing the head, the next the shoulders between the fourth and fifth ribs, and the next removing the hams about 2 inches to 3 inches in front of the pelvic bones, which brings the cut just to the



top of the ham. This divides the hog up so that it may be easily sawed through with a short meat saw. The hams require very little trimming to put them into presentable shape for the pork barrel, and the shoulders can also be trimmed easily by simply removing the ribs and neck piece, and trimming off the rough meat for sausage and lard. The middle is then split through the centre. The lower two-thirds of the side is removed, cutting through the ribs with the saw. The ribs are afterwards removed from this piece just as closely as possible, leaving all the lean meat on the side. Then the piece is trimmed a little along the lower line, and a part of the flabby flank meat removed for lard. That portion of the pig that is best adapted to a good quality of bacon is thus secured for curing.

Of the upper third of the back, the lean muscle, including the ribs, is removed in one piece and makes what is called the pork loin. From this, chops or pork roasts are cut. The fat coming from this back strip is commonly put in with the lard and other fat trimmings and tried out. All lean trimmings, of course, are made into sausage. The head and feet are cleaned up and used for head cheese or pickled.

Curing.

A great deal of the value of the product depends upon proper curing. Meat should never be salted until all of the animal heat is out, but as soon as the heat is out the quicker it is salted the better. On the other hand, meat should never be allowed to become stale, with an idea that salt will cure the staleness. It may cover it up, but it can never remove it. In salting down, especially during the cool weather and for winter use, it is advisable to use some sugar with the salt and saltpetre, in order to give it a milder, sweeter cure. A good recipe is as follows: 8 lb. common coarse salt; 2 lb. brown sugar, or 1 quart of treacle; 2 oz. saltpetre, and 4 gals. water to each 100 lb. meat. In warm weather 2 lb. more salt, and 2 oz. more saltpetre should be

used. The meat should be packed closely in a clean barrel (hardwood preferred), or in a crockery jar large enough to hold the required amount. The salt, saltpetre, and sugar are dissolved in the water and then turned over the meat.

If there is not sufficient of the brine to cover the meat, more brine of the same strength is added as any portion of the meat uncovered is likely to rust and spoil, and in a short time the brine in the whole barrel would be spoiled. A cover and weight should be placed on the meat to keep it below the brine. In warm weather it is advisable to boil the brine and allow it to cool before putting it over the meat. The sugar, if used in larger quantities, is likely to make a "ropey" brine and one which will not keep so long as one without sugar, but, if the pork is cured in the winter for summer use, this will give the meat a good flavour, and it will not be so tough and hard as when cured in clear salt. The brine has not strength enough to overcure the meat, but still it has sufficient to keep it for almost any length of time. Six to eight weeks in brine of this strength will cure bacon and hams weighing 12 to 14 lb. While it may remain in the brine much longer than that, the best quality of meat will be obtained if removed from the brine as soon as cured through. Smoke and pack away for summer-keeping.

A New Lucerne Pest in the Tamworth District.

The Entomologist has received specimens of lucerne badly infested with a small chalcid wasp that, in the larval stage, feeds on the interior of the seed-capsule of lucerne. Here it pupates, emerging through a small hole which it bores in the side just when the seed is fit for gathering. As such seed is, of course, useless for sowing, and as the sale of lucerne seed is a source of considerable profit to local growers, the increase of this pest may mean a serious loss to them. It is evidently widely spread, as the Entomologist has had reports of damage from four different places.

The identity of this insect has not yet been determined, but it is evidently closely allied to, if not identical with, a seed-eating chalcid, *Brachophagus funebus*, that is well known in the United States as infesting the seeds of red clover and lucerne, and has also been recorded from other parts of the world. It could easily enough have been introduced into Australia by means of imported seed.

Anything attacking a field crop like lucerne is very difficult to combat, but it is proposed to study the life-history of this wasp during the coming season in order to determine the most effective means. Meanwhile, the Entomologist is of opinion that the spread of the pest may be checked by cutting the infested lucerne early, in order that the larvæ will not have time to develop; and obtaining seed from the succeeding crop.

The adult wasp is a tiny shining black creature, only $\frac{1}{8}$ of an inch in length, with light-coloured legs and transparent wings.

It will be necessary to search pretty carefully for the presence of the wasp, but if it should be discovered the precautions indicated should not be neglected.

Orchard Notes.

W. J. ALLEN.

June.

This is one of the busy months in the orchard. In another part of this issue will be found directions for pruning, which should be pushed on as fast as possible now.

There are a good many very large old pear-trees in this State which have ceased to carry profitable crops, and consequently have passed their useful stage. Such trees are a source of danger, as they provide shelter for the grubs of the codling moth. It would therefore be better if the owners of such would uproot these trees, without waiting for one of our Inspectors to compel them to do so, or cut them back to within 15 feet of the ground, or so low that the old and rough bark can be easily removed, and thus prevent them acting as a harbour for grubs of the codling moth.

There are many old apple and peach trees which, owing to the absence of a proper system of pruning, would be much better if they, too, were cut hard back, in order to compel them to force out new growth near the centre of the tree rather than out at the ends of long, weak branches, as is so often the case when pruning does not receive the attention it should. If the grower has any doubts as to the results of this apparently drastic treatment, let him try one or two trees and watch how they turn out. Of course this would have to be followed up next pruning season, many of the young shoots would have to be thinned out, and the remainder properly shortened back, in order that the owner might obtain satisfactory results.

Black Spot of Citrus Fruits.

A start has been made by the Department to fight this disease, and it is hoped by the end of the season that we may at least have some definite information to work upon, although we are not sure that we will. However, if we do not get any results this season, we will not be deterred from keeping up the fight, in the hope of ultimate success.

How to grow Fruit in dry districts.

At our Coolabah orchard, exceptionally satisfactory results have been obtained by a thorough system of cultivation. The orchard, which is a small one, receives the usual winter ploughing, and the soil is kept regularly and deeply stirred during the summer months. Crops of green manure have been grown and turned under. A little stable manure has been used, but the orchard is not irrigated, and yet it produces some splendid crops of

The Orchard, Coolabah Experiment Farm.

citrus and deciduous fruits. Thanks to Mr. Sutton, no trouble is spared to make this orchard a success, and the results achieved have been better than we even anticipated. It is an uncommon thing to see orchards in this dry country, and, even under irrigation, one seldom sees many fruit-trees growing.

An Apricot-tree, 6 years old.

The Coolabah Orchard—showing what can be done in a very dry district by means of thorough cultivation and pruning.

White Louse of Citrus Trees.

Mr. W. Brown, who grows some very fine citrus fruits about 4 miles from Gosford, uses the following spray for the white louse. Some trees had been treated about four weeks prior to my visit, and I could not find any of the scale alive which had been covered by the mixture.

The following is the formula and the method of making it:—

8 lb. sulphur.
10 lb. lime.
1 bar of common brown soap.
5 lb. washing soda.
3 quarts blue oil.

A row of Almond-trees, Coolabah Orchard.

The sulphur, after being mixed with sufficient water to form a thin paste, is put into 10 gallons at nearly boiling point. The lime is then added and the mixture boiled for forty minutes, with the necessary stirring, or until the sulphur is dissolved. Then boil 2 gallons of water in which the bar of soap and the washing soda are first dissolved, after which pour the blue oil in, stirring it quickly until it is properly emulsified, after which add to the 10 gallons of lime and sulphur, and make the whole up to 40 gallons. Spray the trunks and branches of the tree wherever the white louse has made its appearance. I have not seen this mixture tried for Indian wax or red scales, but the washing soda—2 lb. to 4 gallons—has been found a good spray for the Indian wax scale, and the resin, soda, and fish oil spray

or fumigation for the red scale. Either of these latter mixtures are more easily made than the former. The formula as given above for the white louse does not appear to damage foliage, so that there is no apparent risk in applying it at any time. It is not necessary, however, for it to cover much, if any, of the foliage, as it is only on the trunks and main branches that the white louse is found, if it is treated before being allowed to spread throughout the tree.

An Crange-tree at Coolabah Orchard, 6 years old.

Red and other Scales.

It is rather late, but, even so, it is better late than never, and those who have neglected fumigating or spraying for the destruction of scale insects should do so without delay, else they may find some difficulty in disposing of any fruit they have which may show signs of scale. The citrus crop is light, and in consequence good, clear fruit will be at a premium next spring.

Owing to the prolonged dry weather many of the old trees are showing signs of distress, and as a result the fruit is colouring early this season. There is a good set of lemons, and should ample rain fall within the next few weeks it should ensure a plentiful supply next summer, when they will be so much in demand.

Persimmons.

The following varieties appear to be of superior quality, and are well spoken of by Mr. F. Jenkins, of Lisarow, as being well worth growing in the coastal districts:—

The Hayakume.—An oblong, early variety, ripening in March.

Yemon.—Fruit of medium size—flattened—with distinct ribs. Ripens rather late. It resembles the hot-cross bun, and is usually known by that name.

Tanenashi.—Fruit large, conical, bright yellow. A good variety, which requires regular pruning, else it is apt to overbear every other year, and consequently produces but little fruit the season following the heavy crop.

Mr. Watkins, of Thirlmere, forwarded me a very fine-looking apple, which bore strong resemblance in many respects to the Gravenstein. It was the same colour and size, but ripened before that variety, and the flavour was not quite so good. Tree strong, upright grower, with dense foliage; fruit ripened this year about the 10th January—some specimens were ripe a little earlier. This seedling was raised by Mr. Watkins' father in England forty years ago, and was supposed to be a seedling from Hawk's seedling. An early and consistent bearer; fruit sets in bunches, and requires thinning, and is about over by the time the Gravenstein is ripe.

Mr. Watkins thinks so well of this seedling that he is planting all his available space to this variety. It so closely resembles the Gravenstein in colour and size that the coloured plate of that variety, shown some years back, would serve to illustrate it.

"The Agricultural Gazette."

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1909.

Society.	Secretary.	Date.
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N.S.W. Sheepbreeders' Association	A. H. Prince	,, 30, July 1, 2, 3
Pastoral and Agricultural Society of Deniliquin	L. Harrison	July 15, 16
Hay P. and A. Association	G. S. Camden	,, 20, 21
Riverina P. and A. Society, Jerilderie	W. Elliott	,, 27, 28
Balranald P. and A. Society	A. Malcolm	,, 28
Peak Hill P., A., and H. Association	J. A. McIntyre	,, 28, 29
Lachlan P. and A. Association	T. Cadell	,, 30
Narrandera P. and A. Association	W. T. Lynch	Aug. 4, 5
National A. and I. Association of Queensland	C. A. Arvier	,, 7 to 21
Urana P. and A. Society	J. Wise	,, 10, 11
Corowa P., A., and H. Association	J. D. Fraser	,, 17, 18
Ganmain A. and P. Association	A. R. Bolton	,, 18
Forbes P., A., and H. Association	H. J. Brooke	,, 18, 19
Gunnedah P., A., and H. Association	M. C. Tweedie	,, 24, 25, 26
Murrumbidgee P. and A. Association, Wagga Wagga	A. F. D. White	,, 24, 25, 26
Parkes P., A., and H. Association	G. W. Seaborn	,, 25, 26
Northern A. Association, Singleton	F. A. Bennett	,, 25, 26, 27
Grenfell P., A., and H. Association	Geo. Cousins	,, 31, Sept. 1
Barmedman Ploughing Carnival and Horse Parade Society.	P. H. Sheahan	,, 1
Junee P., A., and H. Association	T. C. Humphrys	Sept. 1, 2
Lockhart A. and P. Society	H. Parnaby	,, 7, 8
Young P. and A. Association	G. S. Whiteman	,, 7, 8, 9
Cudal A. and P. Society	P. Gavin	,, 8
Ariah Park A., H., and I. Association	A. T. White	,, 8
Germanton P. and A. Society	James S. Stewart	,, 8, 9
Cootamundra A., P., H., and I. Association	W. E. Williams	,, 14, 15
Cowra P., A., and H. Association	J. T. Martin	,, 14, 15
Albury and Border P., A., and H. Society	W. I. Johnson	,, 14, 15, 16
Canowindra P., A., and H. Association	J. J. Finn	,, 21, 22
Temora P., A., H., and I. Association	John Clark	,, 21, 22, 23
Henty P. and A. Society	P. H. Paech	,, 28, 29
Wyalong District P., A., H., and I. Association	Thos. A. Smith	,, 28, 29
Lismore A. and I. Society	T. M. Hewitt	Nov. 17, 18, 19
Tweed and Brunswick A. Society	F. A. Wildash	,, 24, 25

1910.

Society.	Secretary.	Date.
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Wollongong A., H., and I Association	F. W. Phillpotts	Feb. 3, 4, 5
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Goulburn A., P., and H. Society	J. J. Roberts	,, 17, 18

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Agricultural Gazette of New South Wales.

Broom Millet.

G. MARKS,
Instructor of Agriculture, Hawkesbury Agricultural College.

FROM time to time numerous inquiries are received from different parts of the State asking for information regarding the cultivation, harvesting, and marketing of broom millet. During recent years the price has fluctuated considerably, according to the supply and demand, and in the seasons which follow an unusually high market, many farmers attempt to grow this crop who have but a slight knowledge of the requirements of the plant, and of the practical details from the selection of the seed to the harvesting, curing, baling, and marketing of the brush. The result is, that the market is glutted with millet of inferior quality, and the returns give little, if any, profit to the grower. We have in New South Wales soil and climate admirably adapted for the production of the best quality brush, and it is significant that those growers whose practical knowledge teaches them to produce only the very best are handsomely repaid for their outlay.

Requirements of the Trade.

In the manufacture of brooms, three classes of brush are required, which are popularly known as "inside," "cover," and "hurl."

"Inside" millet is used for forming the inside of the broom, and is generally not more than 17 inches long.

"Cover" is the class used for covering the inside and also for forming the shoulders. It is longer than the former and must be from 17 to 20 inches in length.

"Hurl" is the longest brush, ranging from 20 to 25 inches. It must also be fine and straight, and forms the outside covering of the broom. To give a nice finished appearance, only prime hurl can be used.

About 1½ lb. of brush are required to make an ordinary broom, and the three grades are used in about equal proportions.

The soil, climate, and methods of cultivation determine largely the quality of the brush, but in an average season there would be sufficient of each produced to satisfy the requirements of the trade. When grown under exceptionally favourable conditions, a larger proportion of long brush is produced. It may be used as covers, but owing to its length a certain amount has to be cut off, so that its use for this purpose causes unnecessary waste. On the other hand, a dry season will have the effect of stunting the growth, producing a large percentage of "inside" millet, which can only be worked in the

inside of brooms. Manufacturers have consequently to purchase elsewhere to satisfy their requirements.

It is not intended to go into detail concerning the manufacture of brooms, as this does not exactly concern the grower. Manufacturers require certain classes, and the farmer should aim at producing those classes which invariably give profitable returns.

Condition of our supply.

At the present time there is a great deal of dissatisfaction amongst purchasers concerning the manner in which locally-grown millet is placed upon the market,—so much so that the export trade has been injured, and the attention of the Federal Authorities has been drawn to certain dishonest practices with the view of bringing broom millet under the provisions of the Commerce Act. Whilst a large number of producers grade and bale their millet in a manner that compares favourably with the imported article, it is to be regretted that a certain section pay very little attention to these details. The chief faults may be divided into two classes—1st, those the result of ignorance and carelessness; and, 2nd, those which are brought about by unscrupulous individuals with the sole object of obtaining an unfair and undue advantage over the producer. Those of the former class may be summarised as follows:—

1. The millet is not graded. All classes are packed indiscriminately in a bale.
2. The seed is not removed, or only partially so.
3. Broken, bent, or coarse brush is mixed with the good.
4. The cut is not uniform. Some are cut close to the brush, others have 10 or 12 inches of stalk.
5. The colour is not uniform.
6. Bales badly packed and pressed. Many are irregular in size and shape, and not bound with a sufficient number of wires to stand ordinary handling.
7. Brush destroyed by being packed before it is properly dried, causing it to develop moulds of various descriptions.
8. Absence of distinguishing numbers or marks signifying the quality and weight.

A few of the latter class may be mentioned:—

1. The use of heavy billets of timber in bales.
2. Watering the interior of bales when packing with millet that has been properly dried.
3. Placing in the bales bundles of stems and leaves, useless brush, bagging, scrap-iron, sweepings of floors, quantities of unripe seed, &c.
4. Dressing the outside of bales with prime hurl and the middle with inferior material with the seed left on.

Fig. 1.—Broom Millet.

A—Italian Hurl, showing how it is put up in bundles of uniform quality.
B—Samples of brooms made from same.
C – Samples of brooms made from New South Wales millet.

Fig. 2.

A—Shows how millet is placed on Sydney market by some New South Wales growers.
B—A bale of Californian millet. C—A bale of millet from the Manning River.
D—Bundles of Italian millet, showing the great difference in length, quality, and get-up.

It is unnecessary to enlarge upon some of these dishonest practices, as their effect upon any market must be injurious. Owing to the bales being tightly pressed, and from 4 to 5 cwt. in weight, it is not always easy to detect these faults till they are opened in the factory However, buyers are naturally becoming very alert, and they are compelled to give lower prices, on account of the risk they run. Many manufacturers prefer to leave the local product alone, and import their supplies, finding it cheaper to purchase Italian millet at £40 per ton than use local material at £20. The size, shape, and general appearance of bales is fairly constant with individual growers, so that buyers very soon become familiar with them. These dishonest practices have already severely affected the New Zealand trade, and our millet is being replaced by Italian and Californian samples. As a consequence, every honest grower has to suffer through the evil reputation that this trade has acquired, and receive considerably lower prices for a first-class article, because of the fear that the agents will have to make some allowance to the buyers on account of possible adulteration. The demand for broom millet in this State is limited ; and if its production is to be extended and made profitable, it is essential that the export trade be encouraged in every possible way. The local producer at the present time is protected by a Federal duty of £4 per ton.

Fully 90 per cent. of the millet produced in this State is grown on the rich alluvial lands of the North Coast ; and on several of these rivers—notably the Hunter, Manning, and Richmond—the industry may be looked upon as lucrative and permanent. Many farmers have reported their success with this crop, and would not think of reverting to the far less remunerative occupation of maize-growing. The raising of millet need not be confined to these districts, as, with the necessary care, and the aid of a few home-made contrivances, any land which produces 25 or more bushels of maize to the acre will yield profitable returns. On many of our western slopes millet should also thrive, particularly in those localities where irrigation can be carried out. It is advisable, before entering extensively into the production of broom millet, to ascertain from agents or manufacturers the probable requirements of the trade, with the view of obtaining an idea of the prices likely to be obtained during the season. At the same time, should the prices fall after the crop is harvested, the millet may, if properly cured and baled, be stored for a considerable length of time without injury.

The following information may enable beginners in broom millet growing to avoid some common mistakes, and not to neglect any of the important operations which are essential to success.

What Broom Millet is.

Andropogon sorghum vulgare is a non-saccharine variety of sorghum. It is an annual, somewhat similar in appearance to maize while young ; but it has thinner stems and narrower leaves, and, instead of having male and female flowers on separate parts of the plant, they are both found together in the brush at the top. The flowers are of two kinds—perfect and imperfect.

Fig. 5.—A Broom Millet Plant, White Italian Variety—one of the best kinds grown in New South Wales.

The former are set directly upon the branch, and are accompanied by some of the latter, raised upon little stalks. The fine stems of the panicle or brush are the valuable portions; the other parts are incidental. The brush should be composed of seed-stems, uniform in size, length, elasticity, and toughness, and of a nice bright colour. The soil and general methods of cultivation will largely affect the character and quality of the product, even though good seed be used. By long and careful cultivation and systematic selection certain desirable qualities have been developed and fixed, which remain only so long as the conditions which brought these changes about are reasonably observed. When a plant is grown for a particular purpose it should be the cultivator's aim to keep improving it in the direction most profitable to him. This necessitates a careful study of the plant and its requirements, and the conditions which make for its proper development. In broom millet it is not desirable to obtain a heavy yield of seed, a large development of stalk and leaf, or a sap full of saccharine material, but a special and unusual development of the long, thin stems of which the brush is composed. It makes very little difference whether a large plant is produced or a heavy crop of seed is obtained, provided these stems are long and fine.

Class of Land required.

The soil requirements of broom millet are similar to those of maize. The best results are obtained from the deep, rich, well-drained alluvial lands of our rivers. It is, however, capable of adapting itself to a variety of conditions, and, with proper care and attention, sandy and even gravelly soils, if thoroughly drained, will produce fair returns. Undrained lands make the working and cultivation more difficult; the growth is generally slow and uneven, and there is always the liability of the crop becoming stunted and diseased. To ensure evenness in ripening a soil uniform in character and fertility is essential.

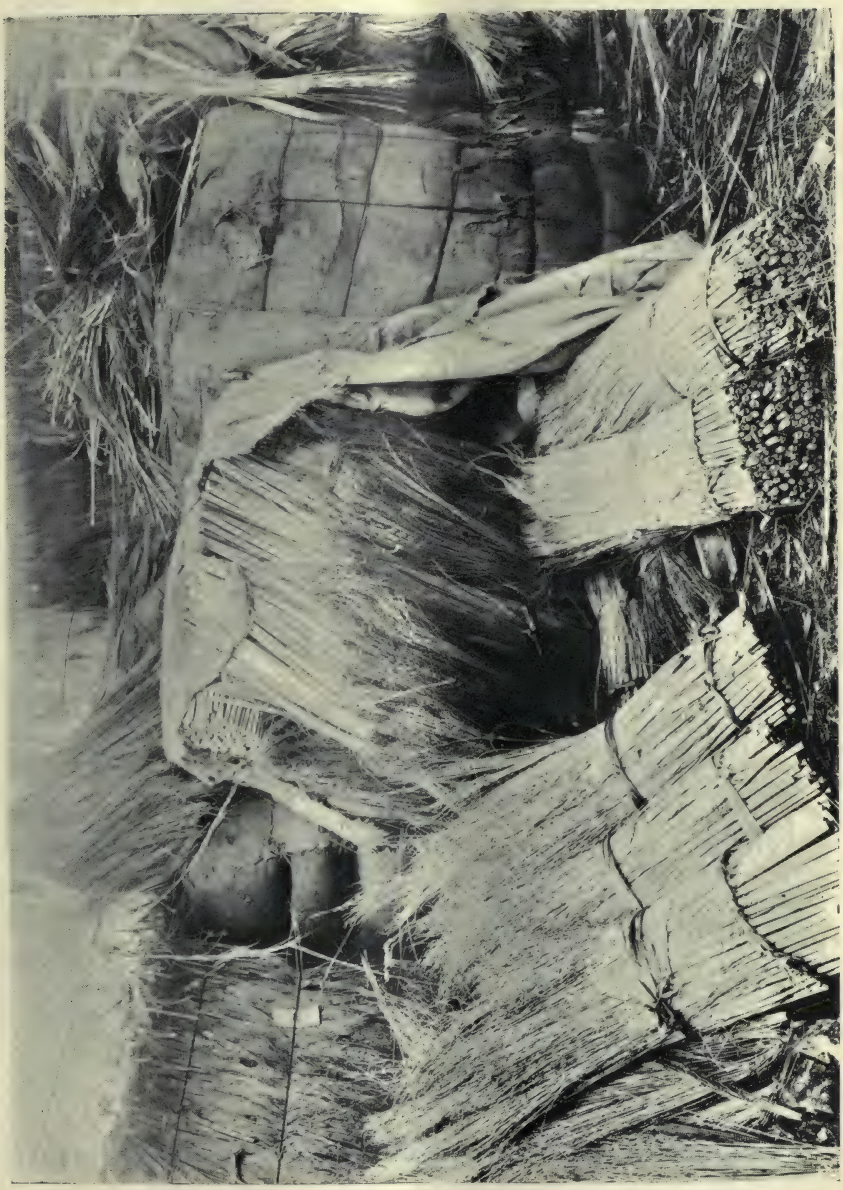


Fig. 3.

Bales of Italian millet, showing one opened and the arrangement of the bundles, and the uniform quality throughout. It will be noted that the bales are covered with hessian and fastened by hoop-iron bands.

Fig. 4.—Bales of Hunter River Broom Millet.

Place in the rotation.

In the general rotation on the farm, broom millet takes the same place as maize. It is not advisable to adopt the practice of growing it in the same piece of land continuously, unless suitable fertilisers are applied. It has been found, however, in dry seasons, that it does not thrive as well on land following millet as where the previous crop was maize. The reason of this appears to be that, being more drought-resistant, it continues to grow and thus exhausts the soil of its supplies of moisture and plant-food, when maize would probably cease growing. At the same time, as the brush is usually harvested soon after the flowers have set, the crop can scarcely be classed as a very exhaustive one, particularly if the stalks are cut down immediately afterwards. Where possible, it should follow a leguminous or root crop.

Preparation of the Land.

To obtain the best results, the land must be properly prepared and brought to a fairly fine tilth before sowing. The previous treatment should be such as would destroy weed seeds. The presence of weeds in the early stages seriously interferes with the growth and cultivation of the young plants. Deep ploughing is recommended. This not only ensures greater feeding room for the roots, but it also has the effect of increasing the moisture-carrying capacity of the soil—a fact which must always be remembered, especially in those districts where the rainfall is limited and irregular.

The nature of the subsoil must also be considered. Clays should not be brought to the surface, but can be materially improved by subsoiling. Ploughing operations should be commenced a couple of months before sowing time. This not only allows the land to sweeten by exposure to the weather, but all vegetative growth turned under is generally well decomposed by the time the second ploughing takes place. In early spring the land should be well fined down by means of the harrow, disc, roller, &c.

Sowing and Cultivation.

Sowing should not take place until all danger of frost is over and the soil is thoroughly warmed, so that the seed will germinate at once. September, October, and November are usually the best months. If planted too early there is not sufficient heat in the soil to cause the seed to germinate, and it will either rot or the young plants will be so weak that the weeds will very quickly outgrow and smother them. It may be sown about the same time as maize, or two or three weeks later, with advantage. Drills 4 or 5 inches deep are struck out with a plough (a double mouldboard one is preferable) about 3 or 3½ feet apart, and the seed planted along these by hand or machine. The latter is preferable, as it sows more uniformly; and by using a fertilising attachment, chemical fertilisers may be applied at the same time. An ordinary maize seed-drill, which sows and covers the seed in the one operation, is one of the best for the purpose. During hot or dry weather the seed should be sown soon after the drills are opened, and before

the soil has had time to dry. When this system is adopted, hilling can be dispensed with. It prevents a great deal of evaporation from the soil by exposing a smaller surface. Besides this, the plants, having their roots deep in the soil, have plenty of support, and are not so quickly affected by dry weather. The amount of seed varies from 5 to 8 lb. to the acre. When the plants are 6 inches high, they should be thinned out to 3 or 4 inches apart for rich soil, and more space allowed each plant in poor ground. With good, clean, and evenly-graded seed, the sowing may be adjusted so that very little thinning is necessary, thereby saving a tedious and rather expensive operation. The quality of the brush is affected to a very large extent by the manner in which this thinning is carried out. If too much space is allowed, the plants grow very strong and vigorous and produce brush which is coarse and unsuitable for market. On the other hand, if crowded too much they become very fine and weak. To obtain an even crop, it is essential to have uniform sowing and germination, and later on to thin the plants to a uniform distance. Some growers prefer to sow the seed in "hills," 15 to 20 inches apart in the drills, leaving from six to ten stalks to each. The seed should be covered from ½ to 1 inch deep, the depth depending upon the character and condition of the soil. If it is dry, deeper covering is more necessary than would be the case if the soil were in a good moist condition. Where labour is scarce, several sowings should be made in succession to enable the grower to deal with his crop at regular intervals, and not have the whole area mature at the same time. Rolling the land as the seed is planted ensures a quicker germination and a better stand, particularly if the soil is a little dry. When drilled, the roller at the rear of the machine is quite sufficient. Should heavy rains fall after sowing, and before the seed has germinated, a light harrow should be used as soon as the condition of the soil will admit. When 6 inches high, the crop may be harrowed to keep the soil loose and to gradually fill in the drills, and thus destroy any young weeds. Broom millet makes rather slow growth for the first couple of weeks, and the cultivator should be kept going every fortnight or three weeks, to keep the surface soil loose and friable, to conserve moisture, and prevent weed growth, and in every instance after rains. For large areas, a two-horse spring tine cultivator may be used. When the crop is half grown, under favourable conditions cultivation may cease; in any case the surface roots must not be disturbed by cultivating too deeply. In moist and exposed situations the crop may be lightly hilled, as an extra support is necessary. It is during the early stages of growth that the cultivator is of greatest value, as the soil may then be loosened fairly deeply. The most critical period is when the heads are forming. If dry weather should set in then, the brush will be short and stunted. It may be necessary in some districts to sow early or late in the season so that the crop will not come into flower during such trying conditions. Where irrigation is practised, it is essential to plant in suitably graded land and convey the water by means of open drills between the rows. After each application of water, and as soon as the nature of the soil will allow, the soil must be well cultivated to prevent caking and to conserve moisture.

Manuring.

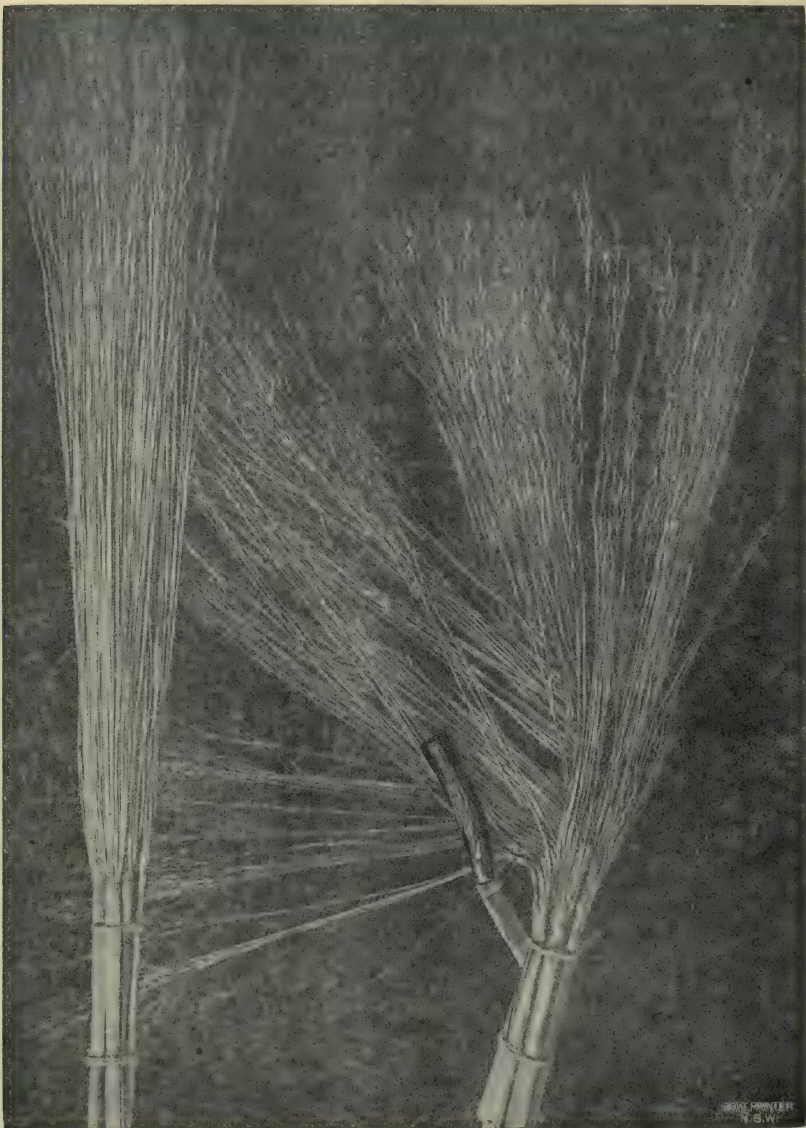
On soils that are somewhat poor, it is advisable to apply fertilisers. Such crops as cowpeas, field-peas, vetches, and clovers are suitable for green manuring, and may be ploughed under when they have reached the blooming stage or have been grazed off by stock. This latter system works well when mixed farming is carried out, and stock of different kinds are kept. Any vegetable matter should be ploughed under early, to give it ample time to decompose before sowing. Farmyard manure, if available, is also a first-rate manure to apply, as it not only supplies the elements required by the plants, but also improves the mechanical condition of the soil. Chemical manures are also valuable, and are very easily applied. Superphosphate, bone-dust, dried blood, and sulphate of potash will be found the most suitable. The quantities used for maize or sorghum will do equally well for broom millet. The following make a complete fertiliser, and may be applied at the rate of 2 to 2½ cwt. per acre :—

Superphosphate	80 lb.
Dried blood	64 „
Bone-dust	50 „
Sulphate of potash	30 „

The manures should be passed through a sieve, to remove lumps and foreign substances that would prevent them from passing freely through the drills. They should be throughly mixed just before sowing, as, if mixed any great length of time before required, they are very liable to "set," especially if the weather is at all damp, and this necessitates breaking up and re-screening before use. It is impossible to state definitely what quantity of manure is required for each class of soil. Growers would do well to conduct experiments on a small scale with manure, mixed in varying proportions, and to notice which give the best results. Soils, even in one locality, often vary considerably in their chemical and physical characters, and by such tests the farmer may soon determine the most suitable mixture for his land. An excessive dressing of manure tends to produce a strong coarse brush.

Bending the heads over.

The practice of bending the heads over is not carried out extensively in this State, and as a result a large amount of bent brush is sent to market, which can be used only as "insides" or "covers." In many parts of the United States of America this operation is never neglected. When allowed to grow in the natural way, a large percentage of the brush will spread out, and bend over on account of the weight of the seed, and thus reduces its marketable value. This is especially the case if there is good rain when the brush is forming. The rapid growth causes the panicles composing the head to become tender, and unable to bear the weight of the growing seed. Strong winds, at this particular period, will also cause this, and grain-eating birds, when plentiful, are sometimes responsible for a great deal of damage. The illustrations, Fig. 6 *b* and Fig. 8, show samples of the brush thus destroyed.



a b

Fig. 6.—*a*—A good sample of brush. *b*—Sample of brush from a neglected crop.

This loss may be prevented by bending the head over, and the weight of the seed in maturing will cause the brush to lie close and straight. The turning must be done between the joints or nodes, as if done on the joints the stem will snap and the top die off. The bending checks the flow of sap a little, but the growth in the head is not materially affected. This operation is performed when the seed is beginning to fill out, and the brush shows signs of spreading.

It should be understood that it is quite possible to grow millet without turning down the heads. Some of the best millet on the market is grown by farmers who do not favour the operation. At the same time, there are seasons when a fairly large percentage is completely spoilt, and such losses could have been prevented by the adoption of this system. The stalks are bent about a foot below the base of the head, and, if the plants are very tall, there may be two bends, as shown in illustration, Fig. 7. The heads should hang clear of the ground, so that they will not be damaged by rubbing, or discoloured by the splashing of mud in rainy weather.

Fig. 7.—A stalk of Broom Millet with the head turned down.

Harvesting and curing.

No matter what care has been bestowed upon the cultivation of the crop, sound judgment must be exercised at time of harvesting. An excellent crop may be brought successfully as far as this stage, and yet the result may be unprofitable on account of inattention to, or ignorance of, some apparently unimportant detail. The time to harvest, and the various other operations required to prepare the millet for market, are such as require some experience in order to do them properly. Even experienced growers are not unanimous on the point of when to harvest the brush, some cutting the heads when in blossom, and others harvesting later so as to obtain better developed seed possessing considerable nutritive value. The time to cut will depend upon the weather and the colour required. Manufacturers generally prefer a millet having a green tinge. It is then much tougher than when allowed to become nearly ripe. To obtain this green colour the millet should be cut when the seeds are in what may be called the dough stage. The brush is then fully developed but the grain is soft. For some classes of goods a golden colour is preferred, in which case the crop is left till the grain is fairly firm. With a little experience it is easy to harvest a large area, and

Fig. 8.—An instance where artificial bending-down would have been profitable.

yet maintain a uniform tint. A strong knife (a pruning-knife is very suitable) is used to cut the brush, and at least 6 inches of stalk should be left on. In dwarf varieties the brush may be pulled instead of cut. Select fine weather for this operation. Some growers bend the stalks of drills towards each other diagonally, about 2 or 3 feet from the ground, forming a sort of platform upon which the cut heads are placed to dry. Others cut the whole of the stalks, and lay the millet upon them.

Drying in the Field.

In this State the millet may be properly dried in the field during the greater portion of the summer months. Should thunderstorms occur, the brush must be placed in heaps and covered with tarpaulins, sheets of iron, or other material. The time required for drying depends upon the season, but still, with fine bright weather, two days should be sufficient. The brush must not be allowed to get wet, as rain or dew soon discolors it.

Drying under cover.

The finest colour is obtained by drying under cover, or away from the direct rays of the sun. The millet is left a couple of hours in the field for

Fig. 9.—Drying Millet in the field.

some of the moisture to evaporate before being taken to sheds fitted up with racks one above the other, so that the brush may be spread out in layers about 3 inches deep. It must be turned regularly at frequent intervals, and when nearly dry may be placed in thicker layers. This method requires plenty of space and a good deal of attention, and it takes longer to dry.

Removal of the Seed.

The seed is removed by means of a hackler.

The machine consists of a roller studded with small iron spikes, mounted in a frame and made to revolve at high speed. A handful of the brush is held so that the roller comes in contact with the seeds, which are speedily stripped off. A firm at Morpeth specialise in millet machinery, and supply these in hand, horse, or belt power, for about £4 10s. and £5 10s. respectively.

For small quantities a handy man can very easily make one, but it is best to purchase one, properly constructed, for treating large amounts.

Grading.

The grading of millet is most important, and must not be overlooked. While grading cannot be done so cheaply or expeditiously on the farm as in the factory, still, in the grower's "own interest, it is essential that some grading be done." It should be sorted into at least three classes, "Inside," "Covers," and "Hurl," and any which cannot be honestly included in any of these classes should be discarded. Green and golden should also be kept separate.

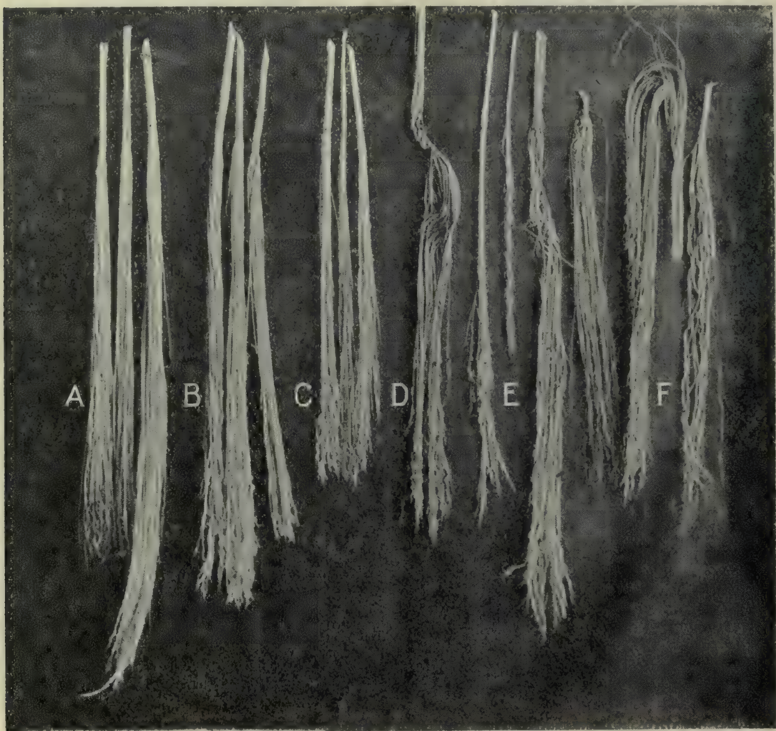


Fig. 10.—Samples of Millet Heads, from prime (A and B) to rubbish (D, E, F).

Baling.

The various grades should be baled separately. For this purpose a press is required. One used for lucerne, or other hay, can be conveniently adapted for this purpose. It is important, especially where space is charged for in freight, to reduce the bulk as far as possible. The brush is laid with butt ends outwards, and the heads overlapping in the middle. Battens may be placed on top and bottom of the bales, and when pressed, the whole is secured by five fairly stout wires. The size varies with individual growers; but a bale 46 in. x 30 in. x 24 in. and weighing from 300 to 400 lb., can be recommended. Each bale should be legibly branded with an indication of the

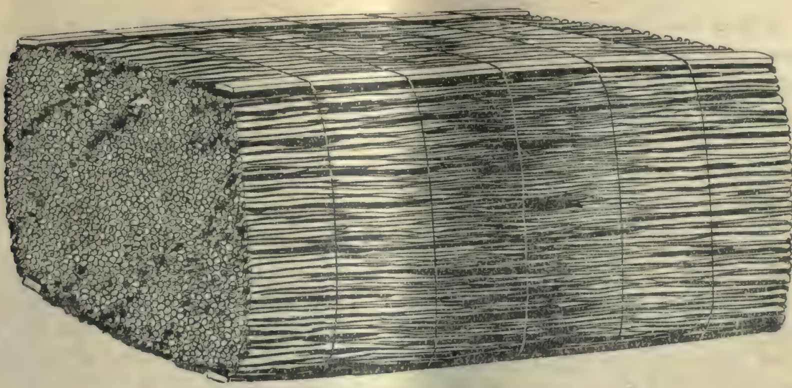


Fig. 11.—A bale of Broom Millet.

quality. There are several styles of home-made presses in use, but one that is coming largely into favour is made on similar lines to a wool-press, having wire ropes and a lever.

Yield.

The yield ranges from 10 to 15 cwt. of clean marketable brush, and 25 to 30 bushels of seed per acre. The price of broom millet fluctuates considerably with the season, and while it may vary from £18 to £40 per ton, the general average for prime hurl may be set down at £30, cover millet at £25 to £30, and inside millet at £20 per ton. Should the prices, however, be somewhat low when harvesting takes place, the millet may be stored for any length of time without deterioration, and disposed of when higher prices are obtainable.

On account of the seed not being properly developed, it is best to consume it on the farm. Its value may be estimated at 4s. per 4-bushel bag.

Selection of the Seed.

Special attention must be given to the selection of the seed. That obtained in the process of stripping should not be used for sowing. The practice of using such would speedily lead to deterioration, and the production of inferior brush.

Good reliable seed can only be obtained by sowing in special areas and allowing the plants to mature their seed naturally. Individual plants may be allowed to ripen their seed in an ordinary field, but there is always a danger of them being hybridised by pollen from plants having inferior brush. In any case, seed should be obtained from those which produce the best heads. By proper cultivation and selection the quality and yield of any variety may be improved. Where seed-eating birds are troublesome, it may be necessary to cover the heads with some light material, such as muslin, when the seed is commencing to fill out. The ends must be tied loosely round the stalk so as not to interfere with the free circulation of the sap. After harvesting, the heads are thoroughly dried, threshed, cleaned, and kept in a place secure from weevils and damp.

Where the conditions for saving seed are not suitable, it is best to purchase from reliable seedsmen. There are several varieties on the market, but so far White Italian has given the best results in this State. At the same time, growers are advised to experiment with new varieties from time to time, or introduce fresh strains of those kinds they have in constant cultivation, with the view of finding out what particular kind is most suitable to their conditions.

By-products.

The object of the cultivator should be to produce brush of the best quality; consequently all other use of the plant must give way to this. In former years millet was allowed to develop a fair proportion of seed, but the diminished value of the brush was not compensated for by the value of the seed obtained. The finest green brush is usually obtained while the seed is in an immature condition, but in the production of good golden-coloured millet, a fair proportion of the grain is more or less developed. This contains an amount of nutriment, and can be utilised for the feeding to stock, thus assisting in reducing the expenses of the crop. It is, however, generally more or less soft and doughy, and if intended to be kept for any great length of time, should be thoroughly dried by spreading out in thin layers on tarpaulins. Growers who insist upon ripening their seed will secure brush of an inferior quality, which brings a low price upon the market, and if exported injures the trade.

Stalks and Leaves.

The plant cannot be recommended as a particularly useful one for feeding purposes. While young a certain amount of sugar exists in the sap, but this soon disappears, and by the time the brush is cut the stalks are more or less dry and pithy, and contain a large proportion of fibre matter which is unpalatable. For this reason very little use is made of them beyond turning stock in after the harvest to feed upon the leaves. The refuse should afterwards be cut up with a heavy disc harrow, or cornstalk cutter, and ploughed under for manure.

Prospects.

As the demand for broom millet in the Sydney market is limited, it is not wise to undertake the cultivation of extensive areas, unless the product is properly prepared and suitable for export. For this purpose, prime brush only should be baled; and if the necessary details in harvesting and curing have been observed, there is no reason why millet should not be exported in a wholesale and profitable manner. On almost every farm the implements to plant and cultivate the crop are found. It will not pay any farmer to obtain the necessary apparatus to treat his brush unless he intends to grow the crop for a number of years. When prepared to do this, and he produces and sends to market millet of the best quality only, it will be found a very remunerative undertaking. In districts where freights are considerable, growers might co-operate and establish small factories, where the whole or portion of their brush could be profitably made up into brooms for supplying the local market.

Tableland Pasture Grasses and Fodder Plants.

[Continued from page 383.]

R. H. GENNYS, Manager, Glen Innes Experiment Farm.

Cocksfoot (*Dactylis glomerata*), or Orchard-grass, as it is generally known in America, on account of its growing so well under trees—is one of the most hardy and generally useful of the introduced grasses, but requires special treatment, as, indeed, most of them do, to obtain its full value.

This grass may be described in appearance as having branching seed heads, the spikelets being set in dense masses at the ends of the branches, stem rough and coarse, leaf broad and dull-looking, the heads are rather liable to the disease known as *Ergot*.

It thrives well in damp soil, such as in heavy clays, and clayey loams in low situations, but in the lighter and drier soils has a tendency to run up too quickly into woody fibrous stalks, and is then very innutritious and indigestible. In moist situations the tendency is rather to stool and make succulent shoots and leaves much relished in their early stages by stock.

Cocksfoot, in no case, should be allowed to seed till the second year. The stools are apt to grow tufty, but a good rolling will flatten them out and increase their dimensions in the right direction.

It is a good winter grass, but probably the early spring is its most nutritious period.

Cocksfoot will stand very heavy stocking when set, improving the growth of young stock and stores, but is not a fattening grass.

As hay it is not of the best quality, and the spring crop only should be used. Cut as soon as the heads appear.

Perennial Ryegrass (*Lolium perenne*).—The seed head consists of a central stem or axis, with the spikelets on either side of it. Leaves are of a dark green colour, ribbed on upper surface, smooth underneath and shining. Flowering glumes obtuse and ribbed, *with no awns* visible.

Perennial ryegrass grows well under most conditions where sufficient moisture is obtainable, but very hot dry conditions are quite unsuitable. Medium and heavy clays agree well with it.

In no case should the grass be allowed to seed under two years, but should be fed lightly either with calves—which are to be preferred—or with sheep or cattle.

Perennial Red Clover will help to fill up the spaces between the stools for time, supply nitrogen, and its habits are deep-rooting, while those of this grass are shallow.

Ryegrass will not exist long where the top soil is poor. Stocking heavily when the grass is established, rather helps than injures the plants, as they stand treading well, and readily avail themselves of the manure deposited by

depastured animals. Its grazing value is good and there is no doubt of its being one of the most valuable of all the grasses. It germinates freely, and occupies the land quickly—an important point in keeping in check weed growths. It is a good grass for milk production, too, and fairly fattening.

Though it is not advised generally to turn permanent pastures into hay, yet, if required, this may be done after the third year, when if cut after the flowering it will be sweet and nutritious, and even the ryegrass straw, after the seed has been threshed out, is much relished by stock. The writer has known horses leave rack oaten hay and eat their bedding made of this grass; and a French writer and agriculturist goes so far as to say, "the ripe straw of ryegrass left after thrashing out the seeds is a better fodder than hay made from its green straw."

Italian Ryegrass (*Lolium italicum*) is similar in appearance to Perennial Ryegrass, the chief difference being that the flowering glumes, tapering at both ends, are *furnished with large awns*, while the perennial rye has none; it grows slightly taller, too, and is lighter in colour. In a rotation combined with clover preceding cereals it is useful, but its value in permanent pastures is very limited, as it is only a biennial, and if used should be sown with perennial rye, the latter gradually taking its place as it dies out.

Timothy or Meadow Cat's-tail (*Phleum pratense*) is a perennial. It grows to a fair height, and has flowering heads of cylindrical form, with small flowering glumes, toothed and awnless, the leaves are rather short, flat, and soft, rising obliquely into the air, and do not curl over like the leaves of some other grasses.

The seed is heavy and of light silvery appearance—an important point, as if too dark it is probably inferior. It does well on heavy clays, stands winter well, and altogether is a rather hardy grass, suitable to sow with red clover. When cut early it makes capital hay, and even if allowed to grow coarse and wiry still contains much nutriment.

Kentucky Blue Grass (*Poa pratensis*) is a splendid pasture grass, sweet and fattening, which spreads rapidly by runners or suckers, somewhat like couch grass, though more underground. It is rather difficult to start from seed, as it must have very careful preparation, and very light covering. It forms a very compact sward and is suitable in this district, combined with a little white clover, for lawns. In this connection it should be sown thickly—say, 50 lb. grass seed to 10 lb. of clover; cut and roll frequently. If land is required for cultivation after grass, avoid this variety, as it is difficult to get rid of when once established.

Prairie Grass is well known as a first-class pasture grass, rich, succulent, and a splendid winter grower. It is one of our best, and for milking cows it is excellent. It does not stand dry hot weather well. Stock are apt to eat it too close to the ground and it disappears if trodden too much. It should be lightly stocked, not fed too closely, and allowed to seed once a year, if only close to the ground, and may then last for a number of years. In enclosures, where it is not eaten down, it grows luxuriantly and often

kills out other grasses and plants. Prairie grass makes excellent hay and is easily saved. It is not always free from smut, which also attacks other grasses.

Phalaris coerulescens, more commonly known at present as *Phalaris commutata*, for it is understood both names apply to the same grass, is undoubtedly one of our very best *frost-resisters*, for it grew continuously, though, of course, slowly, and kept green through last winter, when very severe frosts cut everything, including young turnips, that were growing near it. In no case, during my four years' experience here, have I noticed the leaves of this grass blackened; but I understand this did happen in the Western District during some extra heavy frosts last winter. It may not be as quick a grower as Prairie in winter, but it is making fresh shoots all the time. For comparison, I have two plants growing together, the Prairie being self-sown and the Phalaris planted beside it eighteen months ago. At present the Phalaris has fully eight times the quantity of green fodder in the stool. Nothing was done to these plants except gather the heads and remove dead stalks, but they were kept clear of weeds, and some slaughter house manure was put around them, as the ground was half stones and very poor. The plants were 16 inches apart when planted, and now the Phalaris is growing over the Prairie and will soon kill it, and it already shows signs of dying out; but, in any case, Prairie is not a long-lived grass. It might be mentioned that on the other side of Phalaris is another great frost-resister, *Schedonorus Hookerianus*—not such a good stooler as it, but better than Prairie by a little only. Further, it is worthy of note that *Schedonorus* did better in all cases with no manure. Phalaris seeds but sparsely, which is no detriment to a pasture grass, as heavy seed production is very exhausting to plants and not much use to stock, for what is wanted is a good succulent leafy undergrowth, and the tender shoots constantly arriving from the crowns of the grass make enormous plants in a short time; and, so far as I have tested them, are relished by stock. A chain row of young plants in a grass paddock put in early last spring from seed have been eaten off *four times* close to the ground by sheep during last summer and autumn, and after some heavy frosts are now fresh and green. Will they stand the test of open field-grazing and treading? This has not been proved here yet, but I do not see why the plants should not, as they are strong rooters, and our small experiments argue favourably in that direction. The grass, when in head, grows tall with cylindrical-shaped heads, longer and very much larger than Timothy; also much longer, but not nearly so plump as the seed heads of Canary grass, to which plant it is probably closely related; though the bird-seed plant is only an annual, while Phalaris is undoubtedly perennial. I cannot say that it will resist droughty conditions, though in our dry spells here it does not appear to have suffered more than others, and no roots that have become established have yet died out. Such a grass, if it will stand stocking well, will be invaluable on our cold tablelands during the long winter months.

It appears to make good hay; but it is evident, on account of the large amount of woody fibre, that it must be cut well on the green side—in fact,

as soon as it shows heads. Analysis given below by the Chemist, Mr. F. B. Guthrie, and also of *Schedonorus Hookerianus* for comparison, from plants gathered at the flowering stage.

Schedonorus Hookerianus, another very good frost-resister, but, as the analysis below shows, not anything like equal to Phalaris in nutrient value. It is said only to thrive on high altitudes, and appears from experiments here to do well on poor land and under moist conditions, though it has lived through our driest conditions too. Narrower in the leaf than Phalaris, and more wiry, it is not so well liked by stock; but any green bite in the winter is valuable; and in swamps and water-logged lands that cannot be conveniently drained it may be of much use, as apparently it does not mind sour conditions.

Analysis of *Phalaris cœrulescens* and *Schedonorus Hookerianus*, in the flowering stage, grown side by side at the Glen Innes Farm:—

	Phalaris. per cent.	Schedonorus. per cent.
Moisture	21·88	42·17
Ash	6·21	3·72
Fibre	25·98	19·81
Albuminoids	10·06	3·28
Carbohydrates	34·41	30·06
Ether extract (fat or oil)	1·46	0·96
	100·00	100·00
Nutritive value	47·7	35·4
Albuminoid ratio	1 to 3·7	1 to 9·8

All the above grasses have been tried at Glen Innes Experiment Farm, and do well under proper treatment.

Grasses that have been tried at Glen Innes Experiment Farm, New England, and have been failures after more than twelve months' trial, are:—

Bromus pratense.—A partial failure, as it is still alive, but not in any way vigorous.

Teff Grass.—Two species have been tried; both have died out, after having been carefully treated.

Texas Blue Grass has been tried. Grows fairly; but its quality is not liked, and it would be difficult to get rid of in cultivation.

(*To be continued.*)

Growth of Exotic Trees in New South Wales.

We have so few records of the rate of growth of trees in this State that the following records are interesting. The trees are all in the State Nursery at Campbelltown, and the measurements are taken at 3 feet from the ground.

Pinus insignis.—Planted 22 years; 8 feet in circumference, and about 70 feet high.

Pinus Jeffreyi.—Planted 19 years; 5 feet 10 inches in circumference, and about 70 feet high.

Quercus palustris.—Planted 26 years; 5 feet 10 inches in circumference, and about 40 feet high.

Ulmus montana.—Planted 25 years; 5 feet 10 inches in circumference, and about 45 feet high.—J. H. Maiden.

Rhodes Grass.

A. E. DARVALL, Manager, Moree Experiment Farm.

As far back as 1904, contributors to the *Agricultural Gazette* of New South Wales have mentioned this grass in favourable terms, and as many readers may not be in a position to refer to back numbers, it may not be out of place to quote them again.

Rhodes Grass at Wagga Farm.

p. 812, *Agricultural Gazette*, 1904.

In February last, while nearly all the grasses in the experiment plots at Wagga Farm looked brown and at a standstill, the plot of Rhodes grass . . . was conspicuously vigorous. Mr. McKeown, a couple of seasons back, obtained froom Dookie College a small quantity of Rhodes grass seed. From the plants raised sufficient rootlings were obtained to plant out, on 21st, 22nd September, 1903, the plot nearly an acre in extent. . . . Rhodes grass spreads rapidly, like couch.

The horse in Mr. McKeown's sulky went for the grass quite eagerly, tearing up runners a yard long and eating them with the greatest relish. So far, on Wagga Farm, the Rhodes grass has not been subjected to a determinative grazing test, but judging from its apparent ability to grow vigorously in the hottest and driest months of summer, this grass should prove to be a valuable acquisition to the pastures of the semi-arid districts.

Rhodes Grass at Wollongbar.

C. H. GORMAN, p. 1032, *Agricultural Gazette*, 1905.

So much has been written about this grass that it should be well known to all interested in the introduction and propagation of useful varieties. It was introduced from South Africa, and given trials by a number of graziers and others, Mr. Sylvester Browne being the first to bring it prominently forward. Trials have been carried on at this farm for two years now, from a very small quantity of seed sent to the Director of Agriculture by Colonel Kenneth Mackay, who brought it from South Africa. From the outset it grew well, and larger areas have now been set out with every prospect of success. I have always considered it a good grass, and worthy of trial by those interested. The introduction of new grasses is sometimes the cause of much discussion of a controversial nature, and I have heard many say that Rhodes grass is no good. My opinion is that it will be found of great value, and I think it is a little too early to condemn the grass just because it has not shown itself as luxuriant a grower as, for instance, *Paspalum dilatatum*. When the latter was introduced, it was condemned too early by some, but it has proved itself beyond doubt. Rhodes grass is in about the same position as *Paspalum dilatatum* as regards frost resistance : it will stand a fair amount, but is cut down by a severe frost. There is no indication, however, of its being killed outright—merely a burning off, as in the case of other grasses.

Rhodes Grass for Pigs at Hawkesbury Agricultural College.

H. W. POTTS, p. 1090, *Agricultural Gazette*, 1906.

Another grass of similar root habit has lately come under notice—Rhodes grass (*Chloris gayana*, var.). The creeping stems are thicker, and are inclined to become harsh and fibrous. In the young stage of growth it is, however, very succulent, and, according to the analysis recently issued by Mr. Brünnich, Queensland, it is more nutritious* ; the nutritive ratio is 1 : 8·4. This grass spreads with extraordinary rapidity. Our experience points to the need for keeping it well stocked, to check the growth of harsh stems and a coarse flag.

* Couch is the grass that it is compared with.—A.E.D.

Rhodes Grass (*Chloris gayana*).

J. H. MAIDEN, Government Botanist, *Agricultural Gazette*, p. 1206, 1906.

This article is too long to quote fully, as it occupies, together with illustrations, some twelve pages, but the summing up, which is most instructive, is as follows :—

Now, the virtues of the Rhodes grass appear to me to be as follow :—

1. It smothers Nut grass.
2. It is a good grass for green feed.
3. It is an excellent grass for hay.
4. It is a rapid grower.
5. It has fibrous roots, so it is not likely to be a nuisance, since it can readily be eradicated, if required.
6. The seeds germinate readily.
7. It runs 6 or 8 feet, and then grows erect.
8. It is very palatable to stock.

If it has any vices I do not know of them. In any case, I believe its good points far outweigh its possible bad ones, and, therefore, I recommend experiments with it in many parts of the State. Acclimatisation experiments are undoubtedly full of surprises, and I believe that Rhodes grass—a grass of great vitality—will be found to flourish in many districts where at present it is untried. The seed is very cheap.

Rhodes Grass in America.

Agricultural Gazette, p. 413, 1907.

"I have just read with interest your article in the December number of the *Agricultural Gazette* on Rhodes grass (*Chloris gayana*). We have grown it one year here with moderate irrigation, and it has done better than any other grass that we have imported. It is extremely drought-resistant, heat-resistant, and still quite green after all our frosts."—J. J. THORNBER, Botanist, Arizona Agricultural Experiment Station, U.S.A., in a letter to Mr. Maiden.

In view of the fact that we are feeling our way to the introduction of additional grasses suitable for drought-resistant and frosty localities, this note is of interest. The State of Arizona has much in common with the drier part of New South Wales.—J.H.M.

Rhodes Grass at Pambula.

Agricultural Gazette, p. 590, 1907.

Mr. J. R. Smith, Lochiel, Pambula, writes as follows :—

I put the seed in the ground in the early part of September, and in sixteen to twenty days I noticed the young plants coming up. It did not germinate quite so well as I expected it would, judging from what I had read. However, it seemed to make fairly good headway from the first, and in this respect seems to take the lead from *Paspalum dilatatum*, which, though a rapid grower once it gets a start, does not seem to be so quick at the beginning as Rhodes grass. I fancy that Rhodes grass would soon spread, and the vigorous growth it makes would ensure heavy crops, and in that respect must lead most other grasses, both native and exotic.

As to whether cattle eat it readily or not, I have not enough experience to say, but if they do, it will be a great addition to our grasses.

From the foregoing notes and articles we find that it is a grass easy to propagate ; a quick and luxuriant grower ; has a higher feeding value than Couch, which, in the Moree district, is considered an excellent grass ; stock eat it greedily, whether as hay or in its green state ; will stand a fair amount of frost ; will do with less moisture than perhaps any other grass that has been introduced into this country so far ; and last but not least of its excellent qualities is that it will smother even Nut grass.

Now for our experience on this Farm. An old cultivation paddock, in area about half an acre, was sown with the seed on 20th February, 1908. It had been ploughed comparatively recently; therefore, to avoid getting it into a lumpy condition it was only worked up with a spring-tooth cultivator, followed by a harrow. The seed was sown broadcast by hand, at the rate of 8 lb. to the acre. This proved to be too thick, and when sowing this seed again half that quantity will be used. A light lever harrow, with the teeth set well back, was then taken over the paddock, and since then nothing has been done to it in the way of cultivation. The young grass was showing up fairly well in about three weeks, but a heavy rain drowned some of it out shortly after where the water collected in pools. In May we had early frosts, and later on in the winter we had frost for eleven nights in succession, cold enough to form a quarter of an inch of ice on the horse troughs and to freeze the water pipes. At this period it certainly seemed as though a mistake had been made in not waiting until the spring to sow the paddock, but when the spring came all the young plants that survived put on a nice green shoot. Needless to say, the weeds put in their appearance, also native grasses. To keep these down, horses and cows were turned in at intervals until the latter end of January, 1909, when they were turned out to give the grass a chance. At this time the paddock was practically bare, but having had 222 points of rain on 21st January, the grass commenced to put on a wonderful growth; a further 105 points of rain on 1st February helped it along, and in the latter end of the month it was from 2 feet to 2 feet 6 inches high all over. On 6th March, one-third of an acre was mown, and when dried as hay produced 9½ cwt., or at the rate of 28½ cwt. to the acre; the remainder was left for seed. The illustration, Fig. 1,

Fig. 1.—Paddock of Rhodes grass, Moree Experiment Farm, 13 months old from the seed. Six weeks' growth.

gives a very fair idea of what was really six weeks' growth of grass, and which, in its green condition, must have gone over 3 tons to the acre.

The illustration, Fig. 2, gives a fair idea of how Rhodes grass propagates itself. The plant shown here is from seed, and certainly not more than eight months old from the seed, the ground in which it grew having been under cultivation as late as the end of September last. At the time it was photographed (18th May) it covered a radius of 2 feet 1½ inches, or a diameter of 4 feet 3 inches. It will be noticed that as the stalks grow in height and increase in weight they gradually come down to the ground and become runners if there is any open space into which they can fall; but if the growth is dense, by a wise provision of Nature they support one another and remain upright. Thus a plant having an open space on one side of it and dense growth on the other will drop its so-called runners only on the open side.

Fig. 2.—A plant of Rhodes grass at Moree Experiment Farm, 8 months old from the seed. Showing how the grass spreads.

These runners, as they drop down joint by joint, throw out roots at those joints as they successively touch the earth. Thus, in the illustration the mother plant, A, has thrown out a shoot on the right-hand side. As it grew longer and heavier, having nothing to support it, it gradually came down until the joint B touched the ground, when it immediately threw out roots. Meanwhile the shoot, still growing, gradually brought the joint C to the ground, when it also started to grow, and D will be the next. When the intervening stalk is bitten or broken by cattle, B, C, and D become separate plants and repeat the process. I have never noticed more than the first three joints from the mother plant taking root. They may do so, but it seems probable that it cannot keep the fourth supplied with enough sap to help it along until it can root itself; but this is a mere speculation. The intervals

between the joints average about 4 inches, so it will be seen that it does not take long to fill up any bare spaces in the paddock.

As regards its frost-resisting qualities, so long as it is not kept grazed right down, the tops seem to protect the young growth. We have had several frosts here this season already, but some Rhodes grass that has not been mown has a nice green growth, and that which was mown is showing a nice green shoot after 50 points of rain that fell five days ago.

As feed, there is no doubt that horses and cows are fond of it, either green or as chaff; but sheep have not been tried with it so far on this farm, as we have none.

Taking all the evidence that we have up to the present, there seems to be but little doubt that Rhodes grass would prove to be a most valuable grass for this district. A trial of it on any run would not be expensive, as I believe that it could be put in just by working up the land with a heavy harrow, so long as there is no couch on it. The seed costs about 10s. per lb., but a little goes a long way, and it soon spreads if stock are kept off for a few months and not allowed to eat it right out whilst it is young.

Should any of the settlers in this district wish to try planting out a few roots in the spring, they can be obtained at the Farm free of cost; but seed is the cheapest in the long run; as planting out roots takes a certain amount of labour, and a quarter of an acre laid down this year will in twelve months time, if gathered for seed, give enough to sow several acres.

It may be mentioned, in conclusion, that the trial of this grass has been carried out entirely without irrigation, as it is being tested for its drought resisting qualities. By drought-resisting I do not mean that it will do well without rain, but that it will respond more quickly to a light fall, and keep green longer without any at all than the natural grasses.

A Tree growing in Deep Water.

In sending twigs of the river or fresh water swamp oak (*Casuarina Cunninghamiana*), from Swan Creek, Clarence River, Mr. J. McFarlane, M.P., says that the young trees are growing in a depth of from 12 to 20 feet of water. The trees appear healthy and of vigorous growth. The creek has never been known to be dry, in fact it rarely has less water than at the present time. The tree is figured in Part XV of my "Forest Flora of New South Wales."

Of course the occurrence of such trees on the sides of creeks is common enough, but for a tree to grow and flourish in deep water is remarkable, and should be noted by planters of land liable to considerable submergence.—J. H. Maiden.

Hawkesbury Agricultural College and Experiment Farm.

Feeding of Pigs.

[Continued from page 282, April, 1909.]

H. W. POTTS.

XIII.

Maize, Sorghums, and Millets.

It is generally accepted that maize, or barley, combined with other foods in suitable proportions to balance the ration, affords the cheapest class of bulk food for fattening pigs.

Local market conditions determine the less expensive of the two classes of grain, although there is much to be said in favour of barley, when that grain can be cheaply produced.

Maize.

In discussing the feeding qualifications of maize, it presents itself in three forms—1st, as a stand of green fodder to graze off; 2nd, as a standing crop in the ripening, or ripened stage; 3rd, as a grain in the husk. In both cases, where the crop is grazed, the nutritive ratio will range from 1:7·2 to 1:7·7. Necessarily the ratio will hold good whether the crop be eaten off or cut and given to the pigs in the stye.

Experience has established the fact that greater profit is gained by grazing off in preference to confining the pigs to sties to be fed on cut maize stalks. Pigs are more sturdy and healthy, and secure greater gains in the open. It has been shown that an increase of one-third in weight follows this method. In the green stage it is found desirable to add a supply of skim-milk daily. As cured or ripened fodder the stalks are not quite so relishable.

How to lay out the Paddocks.

Many farmers look on this second method as expensive, thriftless, and lazy; such is not the case. Naturally, good results depend on how this scheme is carried out. Maize, for pig-feeding, should be sown in long, narrow paddocks—say, 10 chains long and 4 chains wide for 4 acres, as shown in diagram. When the crop is ready for the pigs, a line of hurdles, or a movable fence, should be laid across the paddock, in order to enclose a half or a quarter of an acre (according to the quantity of crop and number of pigs). The number of pigs to turn in depends on the condition of the crop and size of the pigs.

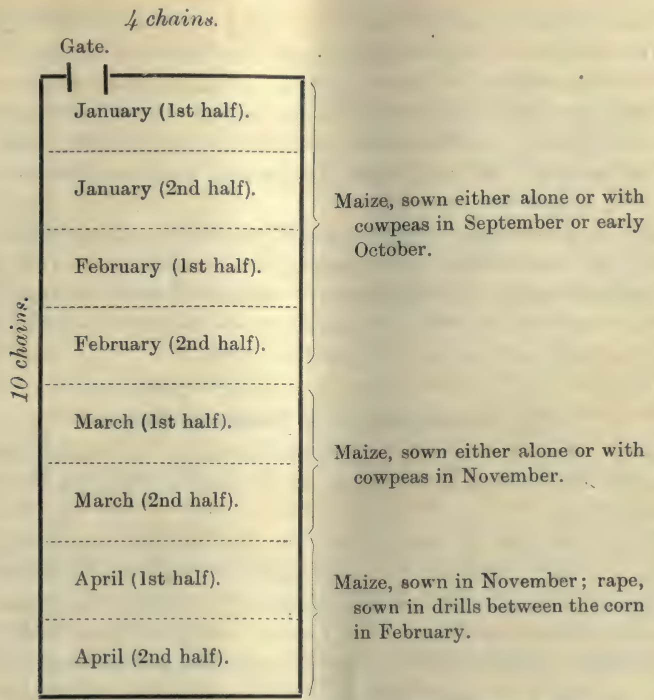


Diagram of 4-acre paddock, 10 x 4 chains, for pig feeding.

A $\frac{1}{2}$-acre section is fenced off (commencing at the end carrying the earliest crop), and when crop is eaten, hurdles are moved to the next area. If the ground is not required, the shelter-shed may be left in the first section, and thus only 4 chains of hurdles and movable fence would be required. By this method the later crops can receive the necessary cultivation.

From thirty to forty young pigs, $3\frac{1}{2}$ to 4 months old, weighing about 60 lb., will dispose of a young crop of maize successfully. It is well to estimate the number to cut down and clean up the section in from fourteen to twenty-one days.

In all cases a shelter-shed of some kind will be required to protect the pigs from sun heat and frosts at night. It is a bad practice to allow them to sleep on damp soil. They need a layer of straw, or other suitable bedding.

The object of hurdling off is to check waste. If pigs are permitted to roam at will through a large block, they rush through the whole area, tear down the stalks, select the succulent and most relishable parts, such as the ears and heads, and leave the other. When this portion has been eaten, the trampled stalks and other less appetising portions have reached the fermentative stage, and prove unprofitable; whereas, with the pigs confined to a small area, they are compelled to clean up all the crop without waste.

Pigs under such conditions develop the most vigorous form of digestion, and are thrifty. They should put on weight at the rate of $1\frac{1}{2}$ lb. per day. This method saves labour, the land is manured and well stirred by the stock,

the few bruised stalks that are left form useful organic matter to plough in, and the land is left in good condition for a suitable rotation crop.

When the first section is cleaned up, the hurdles, or fence, can be moved to take in a similar area. With judicious arrangement in small paddocks, and continuous sowing, maize can be made available for grazing from December to May.

The condition of the crop varies for feeding purposes from the time the grain is well glazed until it is ripe.

In some districts maize may be sown broadcast and somewhat thickly. The stalks are then smaller, and possibly more readily dealt with by young pigs. In the majority of cases, however, owing to climatic reasons, it is wiser to sow maize in drills, in order to permit of adequate shallow cultivation to conserve moisture, and check the growth of weeds.

The Importance of a Balanced Ration.

When the crop is intended for the later period of the season to give ripe grain, it will be good practice to sow at the final cultivation between each row a crop of rape.

The grain crop can be sown to suit the time for the rape, which should not be earlier than February. It will have the sheltering influence of the standing crop; and in eight weeks, with suitable weather conditions, the pigs will have a relishable addition to the maize—valuable from a medicinal, as well as a fodder, point of view. Rape has a narrow nutritive ratio (is rich in protein), and this will render the combination a highly suitable ration. In addition, it will save labour and expense and avoid the necessity of securing the best fattening results by supplementing the standing maize crops with nitrogenous foods.

Under suitable conditions, the inclusion of the climbing varieties of cowpeas in the maize crop have been proved to increase its fattening qualities. Cowpeas provide a ration with high protein contents, and the addition of this to the fodder improves the quality of the flesh.

It may be pointed out at this stage that when pigs are allowed to graze in this way, and with good management, the flesh for pork and bacon develops a tasty flavour, is firm in texture, well marbled, and keeps longer, in marked contrast with that obtained from pigs feed on maize grain alone.

It should also be remembered that, apart from the healthy exercise and environment of open grazing, there is always a quantity of grass and edible herbage available, which assists in rendering the daily diet more appetising, and enriches it in flesh-forming constituents. In many parts of the State maize is a staple grain crop from which there is always an unmarketable residue fit for profitable pig feeding.

Approximately, maize contains 60 per cent. carbohydrates, 8·5 per cent. protein, and 4·5 per cent. fat, with a nutritive ratio or feeding value of 1 : 8·2.

It is invariably the cheapest food for raising pork in many parts of this State; but in order to stimulate the complete digestion and assimilation of the food constituents of maize, it is necessary to associate it with other foods, such as skim-milk or other materials rich in protein.

The continuous and exclusive feeding of maize to pigs tends to produce a flesh of excessive fatness, which, as pork, is inclined to look flabby, and a class of bacon that does not keep well and is deficient in flavour and other qualities demanded by the consumer. This is further emphasised by the tendency in each successive generation of pigs to lose sturdiness of constitution and prolificacy.

These conditions do not in any way lessen the value of maize as a food; it simply directs our attention towards the legitimate and common-sense course of using maize grain as a main basis, and introducing such other foods with the necessary constituents to balance the ration, always keeping in view the element of cost.

We have further to bear in mind that maize is deficient in mineral matter as well as protein, the absence of which results in a weakened bony structure or frame and deficient muscular development. A variety of foods is available, and eminently useful for the purpose of providing these essentials, such as skim-milk, whey, butter-milk, barley, wheat, oats, pollard, bran, peas, cow-peas, lucerne, rape, linseed, clover, grass, vetches, mill and factory products, kitchen refuse, bone-meal, and meat refuse. In all cases wood-ashes and salt should be provided in the stye, yard, or paddock for the pigs to help themselves to at will.

It has been estimated that 4 lb. to 5 lb. of maize grain will produce 1 lb. of pork in a healthy young pig of thrifty strain.

Mr. Joseph Sullivant, of the Ohio State Board of Agriculture, provides a useful table from which the following is quoted:—

"100 lb. maize grain equals in food constituents in pig-feeding:—

103 lb. barley.	618 lb. parsnips.
106 ,, peas.	665 ,, red or white clover (green).
117 ,, rye.	665 ,, mangels.
118 ,, oats.	721 ,, skim-milk.
360 ,, potatoes.	721 ,, carrots.
508 ,, buttermilk.	
598 ,, green lucerne.	

"Ground maize or maize-meal has given a 5 per cent. better return of flesh than the grain fed whole. For quickly maturing young pigs, ground or crushed corn answers best."

In New South Wales, it is practically certain that the same ratio prevails; but of course it is understood that the results would be obtained only by utilising other fodders in conjunction with those enumerated to balance the ration.

Sorghums and Kaffir Corn.

These afford very good grazing crops for pigs throughout the summer. They are noted for their hardiness and power to resist drought, especially towards the end of a hot summer. They will thrive on soils too poor for maize, and can be sown at suitable intervals, to maintain a rotation extending over several months. Sorghums require some attention during the early

stages of growth to ensure a full crop. From the time the crop is a couple of feet high until it has reached its full feeding growth, pigs can be turned in to graze the crop. The matured crop provides the greatest proportion of nutrition.

Where the sorghums prove of greater benefit than maize is towards winter, when the early frosts do not affect the crops to the same extent as maize.

The approximate food constituents of sorghum seed are:—Protein, 7 per cent.; carbohydrates, 65·18 per cent.; fat, 2·86 per cent., which is equal to a nutritive ratio of 1 : 10, as compared with 1 : 8·2 of maize. It is thus seen that it is not quite so rich as maize, but the crop will often yield more seed per acre.

In a test conducted at the Kansas Experiment Station, 1 acre of maize produced 410 lb. pork, and 1 acre of Kaffir corn 487 lb. pork.

The most economical plan is to graze the crop in a similar way to that recommended for feeding off maize.

The difference in flesh-forming constituents ought to be provided by feeding quantities of lucerne, skim-milk, or other nitrogenous foods, or in sowing climbing cowpeas with the sorghum.

Tests conducted at the College Farm have shown young pigs to increase in weight at the rate of 1½ lb. daily when fed on sorghum which they harvested themselves.

Millets.

The early-maturing millets, such as the White French, are looked on in this State as really a catch crop to replace the summer fallow, and at th College Farm they have proved to be remarkably drought-resistant. Sown as a catch crop, we have had a full growth of White French millet in sixty-five days. The crop may be used for grazing pigs when green, or later on for the grain, of which the yield generally is very heavy.

The grain is noted for its easy digestibility, and hence is valuable for feeding young pigs, and sows suckling their litters. The nutritive ratio is similar to that of maize, and whilst it does not produce such heavy yields of either green-stuff or grain, yet millet often provides a crop for feeding, both green and ripe, when maize and other foods are not obtainable.

(To be continued.)

A New Process for Sterilising Milk.

In January last, a new process for sterilising milk was tried at Edinburgh, under the superintendence of Dr. Budde, of Copenhagen. It depends on the presence in milk of an enzyme *(Catalose)*, which decomposes hydrogen peroxide with liberation of oxygen. The milk is heated to 120 degrees F., and treated with hydrogen peroxide. After a time the pathogenic organisms are destroyed, and the milk is run into sterilised bottles fitted with air-tight stoppers, and is then ready for delivery.—*Nature.*

Worm Tumours in the Stomach of the Horse.

MAX HENRY, M.R.C.V.S., Government Veterinary Surgeon.

INQUIRIES are continually being made at the Stock Branch as to the nature of certain tumours found in the stomachs of horses which have died from one cause or another, and have been opened, and in many cases death is attributed to the presence of these tumours.

The tumours are usually found in the cardiac or first half of the stomach, though they also occur in the pyloric portion. There may be only a single tumour, or they may be so numerous as to cover the larger portion of the inner surface of the stomach. They vary in size from about an inch in diameter to the size of a small saucer, appear usually of the same colour as

An old tumour, taken from the stomach of a mare, and cut across.*

the normal stomach, and are quite firm to the touch. When cut into they are found to be composed of firm whitish tissue, with in the middle a greater or less amount of cheesy yellowish-grey material.

If a close examination is made there will be found in the centre of the tumour a small aperture leading from the stomach into the middle of the

* I am indebted to Mr. Grosse, of the Government Printing Office, for this photo.

growth, and here will be found numerous small thread-like white worms, varying from a third to half an inch in length. These on examination generally prove to be the *Spiroptera megastoma.*

The tumours are due to the irritation caused in the connective tissue by the worms burrowing under the mucous membrane lining the stomach.

In old tumours a large area of this mucous membrane is found at times to be destroyed, and the amount of yellowish cheesy material much increased. No living worms will be found in such tumours. In no case has perforation of the stomach wall been recorded.

These tumours are so frequently found in large numbers in the stomachs of horses which have died from some obvious cause, and they are placed in a position where they can do so little harm, that it is very doubtful whether they ever really cause serious trouble to the horse containing them.

However, if in large numbers in the pyloric portion of the stomach, they might interfere to some extent with digestion, or the passage of food into the intestines. It is certain, however, that they do not cause the sudden deaths usually attributed to them, and which are generally due to "colic" from some other cause.

Treatment is, of course, out of the question, even if there were any means of telling when a horse was infested, nor is it a question of importance. The experience of the Stock Branch shows that this parasite enjoys a wide distribution in New South Wales.

Is Millet fatal to Rabbits?

Mr. G. H. Crowhurst, of Tomingley, has raised a rather interesting question. He says: "I put in several acres of Hungarian millet on an area that was not wire-netted. The rabbits made a great attack upon it soon after the plants came above the ground. Latterly the ravages of bunny appeared to have ceased altogether; in fact, bunny appears to have ceased himself, as I can see none about, and, moreover, I have examined many of the burrows after rain, and there does not appear to be any evidence of the presence of a rabbit. The question is: Did the millet, in its early growth, kill the rabbits?" The matter was referred to the Chemist for investigation. Mr. Guthrie reports that it is not unlikely that young millet is poisonous to rabbits. Sorghum at an early stage of its growth contains a substance which yields prussic acid, and instances of poisoning (of dairy cattle especially) from eating young sorghum are frequent. It is necessary to have samples of millet in the stage referred to for chemical investigation in order to determine whether it contains any of the so-called cyano-genetic substances.

It was too late to obtain any plants for investigation last season, but Mr. Crowhurst intends to give the matter a systematic trial during the coming season, and also to induce other landholders to do the same, in order to ascertain whether the millet in its young stages is actually fatal to the rabbits. The Chemist will be glad to receive, when available, samples of millet in various stages of early growth for examination.

Notes on some Australian Parasites

T. HARVEY JOHNSTON, Bureau of Microbiology, Sydney.

HUMAN beings and live stock harbour a great number of animal parasites, many of them belonging to the Protozoa, a very extensive group, which includes all unicellular animals. It will, no doubt, be of some interest for us to know what forms have been recorded as occurring in Australia, and especially in our own State.

The purpose of the investigations now being conducted in the Bureau of Microbiology is to discover effective means of combating these evils, and possibly what is of even greater importance than combating them, preventing them from gaining admission to their hosts.

Amongst the Protozoa, I have had the opportunity of examining the following organisms from human beings in New South Wales :—*Amoeba hystolytica* (*A. dysenteriae*), from abscesses of the liver; *Amoeba buccalis*, from decaying teeth; *Spirochaeta refringens* and *Treponema* (*Spirochaeta*) *pallidum* of syphilis; *Spirochaeta buccalis*, from the mouth; and *Plasmodium vivax*, a malaria parasite which infests the red blood corpuscles.

My colleague, Dr. J. B. Cleland, brought from Western Australia a collection of parasites, which included *Treponema pallida*, *Spirochaeta buccalis*, a spirochaete discovered and described by him as *S. aboriginalis*, *Plasmodium vivax*, and *Filaria nocturna*, from man, besides *Trypanosoma Lewisi* and *Haemogregarina* (*Leucocytozoon*) *muris* from the blood of rats (the former organism being fairly common in our rats and mice, *Mus rattus*, *M. decumanus*, and *M. musculus*); *Babesia* (*Piroplasma*) *bovis* or *bigeminum*, the parasite of Texas or tick fever of cattle (an organism which also occurs in New South Wales); *Microfilaria immitis*, from the blood of a dog, &c.

The important group of flat-worms includes, besides other classes, the flukes or Trematodes, and the tapeworms or Cestodes. These are rather uncommon in human beings in Australia. The liver fluke, *Fasciola* (*Distomum*) *hepatica*, a very common parasite in sheep in New South Wales, Victoria, and Western Australia, and found occasionally in cattle (Western Australia and New South Wales), and in the kangaroo (*Macropus major*) (New South Wales, Queensland), has on one occasion been reported as having occurred as a human parasite in South Australia. Similar occurrences have been reported, though rarely, from other parts of the world. The blood fluke, *Schistosomum* (*Bilharzia*) *haematobium*, has come under observation in a few patients, who became infested with it during the South African war. During this year a case has come under the notice of the Bureau. Another foreign parasite, *Opisthorchis sinensis*, a human liver fluke, has been met with in Sydney in some Chinamen.

Human Cestodes, or tapeworms, are also comparatively rare here. The three commonest tapes, which are known to inhabit the intestines of man, are *Taenia solium*, *Taenia saginata*, and *Dibothriocephalus latus*. In countries where the pig furnishes the main meat supply, *Taenia solium*, the armed tapeworm, is the commonest of the three mentioned, since its larval, cystic, or bladder-worm stage, *Cysticercus cellulosæ*, occurs in the muscles of the pig. Such meat is popularly termed "measly pork." *Taenia saginata* predominates in lands where the ox is usually eaten, the bladder-worm, *Cysticercus bovis*, occurring in that animal. Since the larval stage of *Dibothriocephalus latus* lives in the muscles of certain edible fish, *e.g.*, the pike, the adult only occurs normally in districts where fish forms the main meat diet. There are in the Bureau collection, specimens of these three tapeworms, all obtained locally. *Taenia saginata* (*T. mediocanellata*), has been only once before reported from the continent, viz., from Adelaide. However, it is not nearly so rare as the others, and I have examined a number of specimens collected in Sydney. Its cystic stage, *C. bovis*, appears to be very uncommon, and has not yet been reported from Australia. There can be little doubt that it is here, otherwise man could not have been infected locally by the worm.

Taenia solium is very rarely met with, only a few examples having come under my notice. I have a few specimens of its cystic stage, *C. cellulosæ*, from local "measly pork." There is no other Australian reference to the occurrence of this cysticercus, whilst there are only two doubtful references to *T. solium*. The last of the three, *D. latus*, the broad tapeworm of man, is practically absent, no occurrences of it having ever been reported from Australia. One specimen was taken locally, probably from a foreigner, who became infested elsewhere.

Amongst the other Cestode entozoa, which have occurred in man, are the following:—*Dipylidium caninum* (*Taenia elliptica*, *T. cucumerina*), *Hymenolepis* (*Taenia*) *diminuta*, and *Hymenolepis* (*Drepanidotaenia*) *lanceolata*, all being only accidental infections. The first-named is very commonly met with in the intestines of dogs and cats in Sydney, the second in local rats and mice (*Mus rattus*, *M. alexandrinus*, *M. decumanus*, and *M. musculus*), whilst the third inhabits the intestines of poultry, specimens of which I have seen from a goose here. These two species of Hymenolepis have not been previously recorded from Australia. There is no report of any of these three having been taken from human beings here.

The larval stage of a very small tapeworm, which, in its adult stage, is known as *Taenia echinococcus*, and occurs in dogs and dingoes in New South Wales, South Australia, and in all probability in all the other States, gives rise to large cysts, known as hydatids, or more commonly, simply as cysts. Its scientific name is *Echinococcus polymorphus* (*E. veterinorum*, &c.). Human beings are very liable to its invasions, no organ being safe, though the bones are very rarely affected by it. It is common as a human parasite in every State in the Commonwealth. In addition to specimens from man

(New South Wales), I have examined local examples from sheep, pigs, oxen, and rabbits. It has been taken from horses (Victoria) and the kangaroos, *Macropus dorsalis* and *M. major* (Queensland, New South Wales).

Round-worms, or Nematodes, are much more frequently met with than flat-worms. Children in this State commonly harbour the thread-worm, *Oxyuris vermicularis*, whilst the large round-worm, *Ascaris lumbricoides*, occurs here in adults rather than in children. Other nematodes recorded as having been taken in the Commonwealth from man are the whip-worm, *Trichocephalus trichiurus* (*T. dispar*), from Queensland and New South Wales; *Trichinella spiralis*, the cause of trichiniasis, from South Australia; *Filaria Bancrofti*, and its larval form, *Microfilaria nocturna*, from Queensland, South Australia, New South Wales, Western Australia; *Filaria demarquayi* (New Guinea); *Filaria medinensis* (?) (Victoria); *Strongyloides intestinalis* (Queensland); *Ankylostoma* (*Dochmius*) *duodenale*, from Queensland and Tweed River, New South Wales; and *Eustrongylus gigas* (?) from New South Wales. Many of the above-mentioned nematodes had not been previously recorded from our State.

Strongylus apri (*S. paradoxus*), a parasite found in the lungs of pigs in New South Wales and Western Australia; *Ascaris canis* (*A. mystax*), which occurs in the intestines of dogs and cats in our State; *Echinorhynchus moniliformis*, which infests rats (*Mus rattus*, *M. decumanus*) and mice (*M. musculus*), especially *Mus rattus* in Sydney; and *Gigantorhynchus gigas*, an organism found in the intestines of pigs in New South Wales, have been recorded as occasional or accidental human parasites in other parts of the globe, but apparently not in Australia.

I have identified a number of entozoa from Australian horses, the list being as follows :—The three cestodes which infest this host, *Anoplocephala plicata*, *A. perfoliata*, and *A. mamillana*, were all from our own State, the first-mentioned being the commonest. Mr. A. M. Lea, Government Entomologist of Tasmania, informed me that *A. perfoliata* was present in horses in that island.

Amongst the round-worms there occur *Ascaris megalocephala*, the largest known nematode, *Oxyuris curvula* (specimens of which Mr. Lea sent me from Tasmanian horses), and its *mastigodes* form, *Sclerostomum edentatum* (*S. armatum*), *Cylichnostomum* (*Sclerostomum*) *tetracanthum*, *Spiroptera megastoma*, and *Spiroptera microstoma*, all from New South Wales.

It is well known that bot-fly larvæ live as entozoa in some part of the alimentary canal of horses. Of the six or seven known horse bots, at least three occur in our State, viz., *Gastrophilus equi*, *G. nasalis* (*G. salutaris*), *G. haemorrhoidalis*. After having examined a goodly number of the larvæ, it appears to me that the common bot is not *G. equi*, as is generally believed, but *G. nasalis*, *G. equi* being comparatively rare, whilst *G. haemorrhoidalis* is quite uncommon. Of course, these remarks of mine apply to the larvæ. That of *G. equi* bears two rows of spines on the anterior border of each segment, whilst the larvæ of *G. nasalis* possesses only one. Hence they are readily separated from one another.

A collection of entozoa from a mule in Fiji contained *Anoplocephala perfoliata*, *Ascaris megalocephala*, and *Gastrophilus nasalis*.

New South Wales rabbits are infested to some degree with animal parasites, the following having been identified :—*Cysticercus pisiformis*, *Coenurus serialis*, *Echinococcus polymorphus*, *Coccidium oviforme* (*C. cuniculi*), and *Strongylus strigosus*.

Cysticercus pisiformis is found on the mesentery. When eaten by a dog it becomes an adult tape, known as Taenia serrata, a parasite occasionally found here. *Coenurus serialis* from the muscles gives rise to *Taenia serialis* in the dog, this also occurring, though rarely, in New South Wales. As previously mentioned, *Echinococcus polymorphus*, the "hydatid," gives rise to another worm which lives in our dogs, *Taenia echinococcus*.

Coccidium oviforme is a Sporozoan, which infests the liver in enormous numbers, giving rise to a disease known as coccidiosis, or more popularly known as "liver rot." It is not infrequently met with in rabbits sent down to Sydney, but, needless to say, such infected animals are condemned.

Strongylus strigosus occurs in the stomach, but it is not common.

From the mesentery of the guinea-pig, I have removed occasionally small cysts, which were probably *C. pisiformis*. In the liver and mesentery of our sheep there is frequently seen another cyst, *Cysticercus teruicollis*, the adult being *Taenia marginata*, a large tapeworm, fairly common in dogs in this State and in Victoria. This larval form has been taken from sheep (New South Wales, Western Australia), pigs (New South Wales, Western Australia), cattle (New South Wales, Western Australia), and goats (Western Australia). It is worth noting here that this is the only record of any parasite having been taken from a goat in Australia, the specimens referred to having been collected by Dr. J. B. Cleland whilst he was connected with the Board of Health in Perth, Western Australia.

It is worth while recording, also, the occurrence of the following parasites in New South Wales, most of them being mentioned for the first time as occurring in Australia :—*Spiroptera strongylina*, from the stomach of a pig; *Trichocephalus crenatus*, *Gigantorhynchus gigas*, and *Ascaris suilla*, from the intestine of the pig; *Sclerostomum hypostomum* (South Australia and New South Wales), and *Moniezia alba* (New South Wales) from sheep, and *Oesophagostomum inflatum* from the calf. Our sparrows harbour a tapeworm, *Monopylidium passerinum*, and a bird-malarial blood parasite closely resembling *Plasmodium praecox*.

IMPORTATION OF DISEASED POTATOES PROHIBITED.

THE Minister of Agriculture directs attention to the proclamation published 15th June, 1909, prohibiting the importation into New South Wales of potatoes affected by Brown Rot or Wet Rot (*Bacillus solanacearum*) and Dry Rot (*Fusarium solani vel oxysporium*).

Milk and Butter-fat Records at Wollongbar Experiment Farm.

H. R. ALEXANDER, Manager.

THE need and desirability of recording milk and butter-fat records is admitted by the majority of dairy-farmers. Once established on a dairy farm, the value of the Cow Performance Register will become more apparent every year of its existence. Not only will the register determine the value of each individual cow, but by comparing yields during different seasons and under various feeding conditions the farmer can determine whether the increased milk or butter yield pays when cows are fed on any crop, hay or silage. A Milking Register of several years' standing makes most interesting study; and by such study the farmer not only sees the advantages derived by culling and using nothing but the best bulls as sires of his next generation of milkers, but he also learns many small things in the care and management of his stock that all tend towards making an already good cow a better milker. To our Richmond River dairyman I say, keep Cow Records and

Fig. 1.—Holstein Cow Boswe, born 13th March, 1903.

cull; sell the culls to the butcher—not to another dairy-farmer—and by so doing increase, or even double, the already magnificent output of this favoured locality without adding to the number of cows in our individual herds.

Period.	**Boswe**—Date of Calving.	Lactation period in days.	Yield of milk, in pounds.	Total yield of Butter-fat. lb.
1	26 November, 1905	317	9,073	333·36
2	11 December, 1906	364	10,576	410·86
3	14 March, 1908...	256	7,341	257·66

On the day photographed Boswe gave 51 lb. milk, testing 3·4 per cent., in the twenty-four hours. Calved twenty-two days.

Fig. 2.—Grade Guernsey Bud (by Peter, imp.), born 13th March, 1902.

Period.	**Bud**—Date of Calving.	Lactation period in days.	Yield of milk, in pounds.	Total yield of Butter-fat. lb.
1	23 June, 1904	332	6,810	424·98
2	21 May, 1905	252	3,362	219·37
3	28 April, 1906	580	12,455	735·24
4	29 December, 1907	257	5,685	303·01

The falling off in milk and butter yield in Bud's second calf shows the loss incurred by not being able to give the cow a reasonable rest between drying off and calving.

Bud gave 35 lb. milk, testing 4·5 per cent., on the day she was photographed. Calved twenty-eight days.

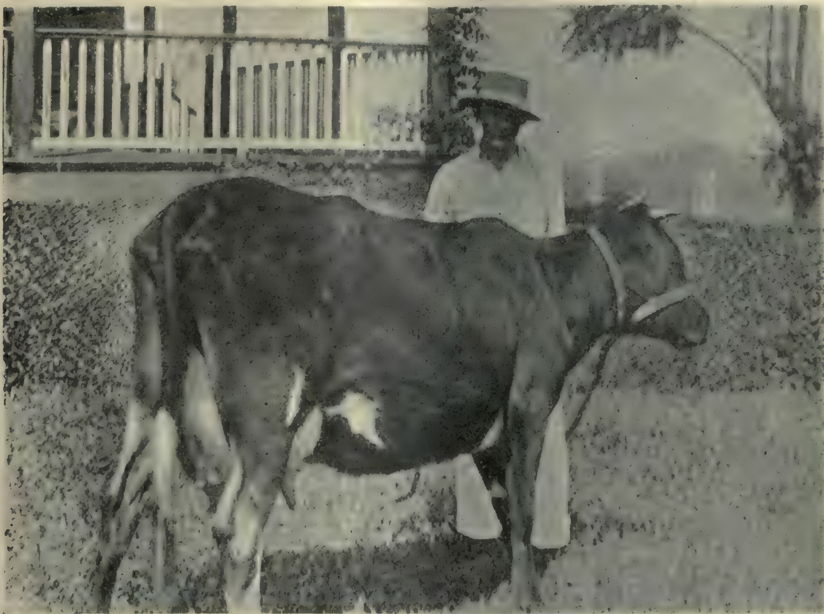


Fig. 3.—Doreen, a direct cross between the Shorthorn cow, Lady Dora (imp.) and Guernsey bull, Peter (imp.).

Period.	Doreen—Date of Calving.	Lactation period in days.	Yield of milk, in pounds.	Total yield of Butter-fat. lb.
1	4 January, 1905	299	6,103	280
2	23 January, 1906	597	13,627	651·57
3	31 December, 1907	258	7,105	259·15

On day photographed Doreen gave 41 lb. milk, testing 3·7. Calved twenty-eight days.

Fig. 4.—Group of milkers, all bred on the Wollongbar Experiment Farm.

Fig. 5.—Group of young bulls, all bred on the Wollongbar Experiment Farm.

Photograph No. 4 shows a group of Wollongbar milkers, all bred on the farm.

Photograph No. 5 shows young bulls, as exhibited at Alstonville Show, bred on Wollongbar Experiment Farm.

The stud bulls stationed at Wollongbar Farm at present include—

Shorthorns—Pansy Duke.
Ayrshire—Jamie's Ayr.
Guernsey—Gentle Prince; Prince Souvia.
Holstein—Obbe II.
Jersey—Thessalian II.

These bulls and others, as shown on page 594 of this issue, are available for service or lease.

The records of the Wollongbar cows, though good, fade into insignificance when compared with the Bangalow butter-fat winner, Lady.

Milk and butter record of Lady, the winner of 1909 butter-fat prizes at Alstonville and Bangalow Shows. Owned by Mr. J. J. King, Alstonville:—

Month.	Morning's milk in lb.	Average of Butter-fat Test of morning milk.	Evening's milk in lb.	Average of Butter-fat Test of evening milk.	Total lb. of Butter-fat.
Calved, July 26...	131	6·	130	6·2	15·92
August	1,228	4·38	931	5·74	107·21
September	874	4·06	684	5·2	71·04
October	735	4·74	621	5·64	69·85
November	596	5·37	521	5·6	61·17
December	602	4·85	581	5·58	61·6
January	685	4·2	620	4·5	56·67
	4,851		4,088		443·46

In 189 days this cow has produced 8,939 lb. milk, yielding 502 lb. commercial butter, or 2·65 lb. of butter per day.

Fig. 6.—Lady, the Winner of Butter-fat Prizes at Alstonville and Bangalow Agricultural Shows, 1909.
Owned by Mr. J. J. King, Alstonville.

On the dam's side Lady is descended from a bull named Australian Hero, a son of the imported Ayrshire Earl Beaconsfield.

Earl Beaconsfield was the sire of Mr. J. Lindsay's famous cow Honeycomb, showing the value of a milking pedigree.

BANGALOW £100 BUTTER-FAT PRIZE.

THE prize-winner was Mr. J. J. King's (Alstonville) Lady. On her first test, 25th August, she gave in the morning 37½ lb.; test, 4·4; butter, 1·855; evening, 30½ lb.; test, 3·11; butter, 1·87; total, 3·725 butter. On 26th August she gave—morning, 37½ lb.; test, 4·6; butter, 1·935; evening, 34½ lb.; test, 5·6; butter, 2·20; 4·135 butter. A total for the two days of 7·86. The prize has to be won three times by the one competitor, the winner each year getting five guineas. Last year the prize was won by Mr. P. Walker. The entry fee is £5 per year for members and £7 10s. for non-members. The test is for two days—that is, four milkings in succession—and not more than forty-eight hours shall elapse between the preliminary and the final tests. When putting up her best record, this cow consumed nearly 3 bushels sweet potatoes in twenty-four hours, in addition to grass.

Dairy Notes

M. A. O'CALLAGHAN.

THE DAIRY AT THE RECENT WOMEN'S EXHIBITION.

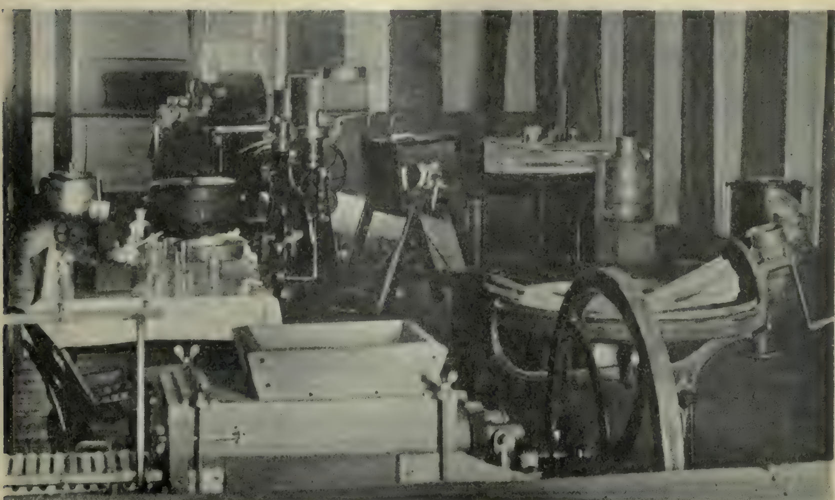
THE Secretary of the Girls' Realm Guild, who recently held an exhibition at the Town Hall, was very desirous that an effort should be made to show on a small scale woman's work in the dairy, and having requested the Minister for assistance, I was authorised to advise them with regard to the organisation of same.

Cheese-making, butter-making, and milk-testing were carried on in the ordinary dairy, which was fitted up in the basement of the Town Hall, while the milking of cattle by machinery was carried on just outside the dairy in the precincts of the Town Hall, cows having been lent by the Hawkesbury College.

The illustration given herewith shows the Lawrence-Kennedy-Gillies milking machine in action, and the work is being supervised by Miss Lamond, of Shoalhaven, who helps to supervise the work of milking by machinery on her father's dairy.

Milking Machine at the Women's Exhibition, managed entirely by Miss Lamond.

The milk-testing and butter-making demonstrations were given by Miss Winnifred Irvine, of Ourimbah, while the cheese-making demonstrations were daily carried on by Miss Binks, of Berry, who is well known as a successful cheese exhibitor.



The Dairy at the Women's Exhibition, Town Hall, Sydney.

The dairy attracted a great amount of attention, and undoubtedly was one of the features which helped to make the exhibition such a financial success.

No sooner was the butter made than it was purchased by people who had been waiting to obtain a pound of the material manufactured by the girls "While you wait."

The women did their work in a very business-like manner, and the result of the demonstrations may be to cause more attention to be paid to the finer parts of dairying by women, especially now that machinery has lightened the task of dairying very considerably.

If the women who look after the cream on the farms while it is waiting to be despatched to the factory were trained somewhat in the scientific side of dairying, a great amount of good would result, because the man's attention to the cream practically ceases when the separating is over, and while he is out working on the farm throughout the day, the cream could have proper attention from his wife or daughter with very beneficial results. Also, it is only natural to expect that if a girl does not understand the why and wherefore of the necessity for perfect cleanliness in all dairying matters, she cannot be expected to put forth her best efforts in seeing that the separator is scrupulously clean, and that all dairy utensils are thoroughly cleansed immediately after having been used.

At the present time the question of washing the separator but once a day, while separating is done twice a day on many dairy farms, is a burning one with factory managers and dairy instructors, and I have no hesitation in saying that if the farmer's wife or daughter understood from a scientific point of view the necessity for cleaning that machine twice a day, it would be done.

Winter School for Factory Managers.

The Minister of Agriculture has approved of a Winter School for Factory Managers and those in training for managerships, being held from the 19th to 31st July inst, at the North Coast Company's Lismore factory, the Directors of which have kindly granted the use of the factory for the purpose. As was the case at the Dairy Science School held at Berry last year, there will be daily lectures covering the entire manufacture of butter from a scientific standpoint, and the practical instruction will cover cream grading, butter making, cream and milk testing, the determination of the percentage of water in butter, milk, &c., and the value of bacteriological tests to the factory manager. Similar courses have been held in recent years at the Dairy Laboratory, but the change has been made for the better demonstration of the Factory Manager's work under practical working conditions. As only a limited number can receive the training during this session, it was necessary, as announced in the metropolitan and country Press, to close the entrance list on 30th June.

Instruction in Milk Testing for Children in Dairying Districts.

Arrangements have now been completed for Dairy Instructors of the Department of Agriculture to give practical lessons in the testing of milk and cream to farmers' children attending the public schools in the following dairying centres of the coastal districts:—

Richmond River and District.

Ballina	Gundurimba	Swan Bay
Broadwater	Kilgin	Tomki
Casino	Lismore	Wardell
Codrington	Oakland	Woodburn
Coraki	Pimlico	Wyrallah

Bellinger River and District.

Bellingen	Fernmount	Nessville
Bellingen South	Gleniffer	Never Never
Bellinger Heads	Gordonville	Raleigh

Macleay River and District.

Aldaville	Greenhill	Smithtown
Corangula	Kinchela Creek	Summer Island
Dondingalong	Pelican Island	Turner's Flat
East Kempsey	Rainbow Reach	Urulgurra
Euroka	Seer Oaks	Warbro
Frederickton	Sherwood	West Kempsey
Gladstone	Skillion Flat	

South Coast (Nowra to Wollongong).

Albion Park	Dapto	Meroo
Avondale	Dapto West	Mount Kembla
Bellawongah	Drowalla	Mumba
Berkeley	Far Meadow	Nowra
Berry	Foxground	Port Kembla
Bolong	Gerringong	Shellharbour
Bomaderry	Jamberoo	Tongarra
Bombo	Jasper's Brush	Toolijooa
Broughton Vale	Keiraville	Unanderra
Cambewarra	Kiama	Wallamolla
Coolangatta	Marshall Mount	Wollongong
Croome		

Each of the four Dairy Instructors who will undertake this special work has been provided with a portable Babcock Tester, and the respective schools will be visited in turn during the winter months.

Mr. Perry is keenly interested in this work, which he feels confident will result in great benefit to the dairy industry of the present as well as of the future, and he has secured the co-operation of the Department of Public Instruction so that the demonstrations may be carried out under conditions most instructive to the children concerned.

At the conclusion of the course of instruction the pupils will be expected to undergo an examination in order to determine whether they have thoroughly grasped the principles of milk testing and are in a position to carry out the work accurately in their parents' dairies.

Government Stud Bulls available for service at State Farms, or for lease.

Breed.	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Dora's Boy ...	Cornish Boy ...	Lady Dora ..	Cumbalum ...	17 Dec., '09.
,, ...	Pansy Duke ...	Earl March ...	Pansy 4th ...	Wollongbar Farm.	*
,, ...	March Pansy ...	Earl March ...	Australian Pansy	Grafton Farm ...	*
,, ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd.	Berry Farm ...	*
Jersey ...	Thessalian II ...	Thessalian ...	Egyptian Princess	Wollongbar Farm.	*
,, ...	Golden Lord ...	Golden King ...	Colleen ..	Wagga Exp. Farm	*
,, ...	Sir Jack ...	Omelette's Pride	Lady Tidy 3rd (imp.).	Berry Farm ...	*
,, ...	Berry Melbourne	Melbourne ...	Rum Omelette	Mt. Irvine, Bell ...	*
Guernsey ...	Gentle Prince ...	Rose Prince ...	Gentle ...	Wollongbar Farm.	*
,, ...	Vivid's Prince...	Rose Prince ..	Vivid ...	Upper Orara ...	Jan., '10.
,, ...	Prince Edward..	Rose Prince ...	Vivid ...	Wyrallah	12 Aug., '09.
,, ...	Star Prince ...	Calm Prince ...	Vivid ...	Alstonville District	17 Dec., '09.
,, ...	Prince Souvia ...	Vivid's Prince...	Souvenir ...	Wollongbar Farm.	*
,,	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Paterson District	Oct., '09.
Red Poll ...	The Judge ...	Barrister ...	Lovely 8th ...	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General... ...	Judy 9th ...	Bathurst Farm ...	*
,, ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
,, ...	Auchenbrain Spicy Jock (imp).	Howie's Spicy Robin.	Another Mayflower	Berry Farm ...	*
,, ...	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
,, ..	Jamie's Ayr ...	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
,, ...	Emerald's Mischief.	Prince Emerald	Miss Prim ...	H.A.College, Richmond	*
,, ...	Dado	Daniel	Dot	H.A.College, Richmond	*
Kerry	Bratha's Boy ...	Aicme Chin ...	Bratha 4th ...	Glen Innes Farm...	†
,, ...	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Dexter Kerry	Waterville Punch.	....	.. ..	Grafton Farm ...	*
Holstein ...	Obbe II ...	Obbe	La Shrapnel...	Wollongbar Farm	*
,, ...	Hollander ...	Bosch III ..	Margaretha ...	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

Candied Peel.

W. J. ALLEN.

Some four years ago a series of experiments was carried out in the making of candied peel, both orange and lemon, and Mr. Hogg, the Orchardist at Wagga, was deputed to watch same and keep a record of the process. This he did, and his report was published in the *Gazette*, and is largely embodied in the following.

Since that time, however, Messrs. Hogg, Alford, and myself have been experimenting, and have, we consider, made a much better article than was put up in 1905.

Plant required to handle from 1 to 2 tons of Lemons.

5 wine casks. (30 gallons capacity.)
2 dozen 4-gallon stone jars, or ten 10-gallon jars, or five 20-gallon jars (as shown in Fig. 2).
4 knives. (For halving the lemons.)
4 pitting spoons. (For removing the pulp.)
1 tin-lined copper or enamel vessel. (30 gallons capacity.)
1 brass sieve. (For removing peel from cask.)
1 perforated ladle. (For skimming syrup.)
1 cwt. salt. (Coarse but soluble.)
15 cwt. sugar. (Any good brand of granulated.)
1 saccharometer. (Beaumé.)
2 large enamelled buckets.
6 draining trays.
1 syrup table.

This completes the outfit, taking for granted an ample supply of fuel and water.

The saccharometer can be had from 5s. up, and is used in determining the density of the syrup after each immersion, because, while we know the quantity of sugar required for the first syrup, we would be in the dark as to how to arrive at the proper density of this syrup for subsequent immersions.

Draining Trays.

These may be constructed of light wood to any required measurement. A convenient size is a frame 3 feet in length by 2 ft. 2 in. in width by ½ inch in depth. To the bottom of these frames may be nailed or screwed ½ inch by ¼ inch battens, leaving ¼ inch spacings. The whole to be supported lengthways by two pieces of 1 inch by ½ inch let into the frame 1 foot apart.

Syrup Table.

This should be really termed a trough. It has a depth of 6 inches, and is so built that the draining trays fit inside it.

The trough is tin-lined, with a drain-cock in one corner. The whole is then given a pitch, so as to facilitate the drawing off of the syrup.

Selection of Fruit.

The early and mid-season lemons contain more of the essential oils than those later in the season; consequently, by utilising the former a better-flavoured article may be produced. The question of colour plays an important part, so it will be desirable to consider it. The lemons may be picked in three stages (providing that they have matured as to size), viz., dark green, green and yellow, and bright yellow. As to the texture of the skin, this also may be divided into three grades, viz., rough, wrinkled, and smooth; and the size into small, medium, and large.

Grading.

This a very important factor, as the following difference in prices is most apparent.

For instance: There is 1d. per lb. in favour of the smooth yellow as compared with the wrinkled yellow; ½d. between the yellow and the dark; and ½d. between the dark smooth and the dark wrinkled. The grading may be carried on at the time of picking. An easy method of gauging the size of the lemons is by passing them through rings of the required dimensions before placing them in the picking-boxes. It is desirable to handle the fruit with all expedition; the sooner it is placed in the pickle the more flavour will be retained.

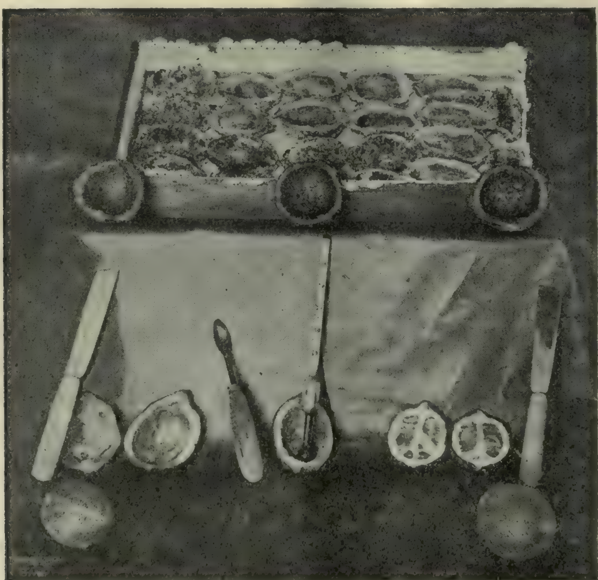


Fig. 1.—Candied Peel.
Showing saccharometer, pitting spoon, knives, cut fruit, and packed box.

Selection of Grade.

As to the standard or first grade, select a bright, yellow-skinned, even-surfaced, medium-sized lemon. The question of thickness of skin does not seem to be of great consequence.

For the second grade, yellow and wrinkled.
,, third ,, smooth dark.
,, fourth ,, rough dark.

Pickling.

Take a cask of, say, 30 gallons capacity; clean with steam, or soda and boiling water. Remove the lid, and pour into it 20 gallons of clean fresh water, and for every gallon of water add and dissolve $1\frac{1}{2}$ lb. to 2 lb. salt. This should read 10° density, by Beaumé saccharometer, and is about strong enough to float a potato. The brine is improved by being boiled, which tends to the prevention of mould. Sea-water, if convenient, may be used.

The lemons are now cut longitudinally (this may be a matter of choice, but the appearance is certainly in favour of it), and the pulp removed by aid of a pitting-spoon. The spoon is shown in Figs. 1 and 4, standing next to the saccharometer. The peel is immediately placed in the brine until the cask is full, taking care that it is always submerged. The lid of the cask may be placed upon the surface and weighted down with bricks or stones. As a word of precaution, take extreme care not to use at any time iron weights or vessels of iron, as the slightest contact of the peel with iron stains and turns

Fig. 2.—Glazed stone jars for brine.
The perforated lid, as shown, is for placing on the top of the peel in the jar to keep it submerged in the brine.

the former black. The peel remains in this brine for at least a month, from whence it is removed, drained, and placed in a cask containing fresh water for two days longer, during which time this water is changed once.

Stone Jars.

Glazed stone jars may be purchased at some of the works in Sydney at 2s. 9d. per gallon, in sizes from 5 to 20 gallons, and 20 gallons upwards at 3s. 9d. per gallon. These jars are the best for holding the peel during the time it is in the brine, as, with wooden casks, there is always a certain loss of liquid which does not occur when stone jars are used.

It will be found upon examining the peel before placing it in fresh water that the brine has acted upon any remaining pulp within the cups, causing it to be soft and pulpy. This can easily be removed with the thumb before placing it in the fresh water, and in fact it has been found that the pulp is so much more easily removed after soaking that it is almost as well not to remove it before placing in the brine, unless the juice of the fruit is required for use.

The same precaution must be adopted with regard to keeping the peel below the surface of the fresh water. At the expiration of two days the fruit is removed, and placed in the cooking kettle, containing cold fresh water, which is raised to boiling point, and the whole simmered for five minutes until the peel is well softened, which, in the case of lemons, will usually be in five minutes, while oranges and citrons are better with from thirteen to fifteen minutes' simmering. From this the peels are taken and washed in cold fresh water, to be immediately spread on draining trays, the cups being turned downwards. This is merely to drain off the water and any superfluous moisture; half an hour is generally sufficient. They may be placed in the sun, as shown, if the weather is cool. When sufficiently dry, the peel is placed in stone jars or wooden casks, containing cold syrup at a density of

Fig 3.—Peel set out on trays to drain.

16° Beaumé. There it remains for two days. By this time the peel will have absorbed much of the sugar from the syrup, thereby lessening the density, which must be increased to 18°, and the peel allowed to remain in this for another period of two days, at which time the density is again increased by 2°, and so on at periods of two days until the density has reached 28° Beaumé; then the syrup is drained off, and the peel immersed in syrup of a density of 32°—where it may remain as long as desired. The addition of a little glucose at this stage will enhance the appearance of the finished article. When the peel has reached this stage—32° Beaumé—it should be tested at the end of the first week to see whether or not it is absorbing the sugar, because if so the syrup will require to be again drawn off and brought back to a density of 32°, until the peel has ceased to absorb any further sugar, after which it may be allowed to remain as previously stated for as long as is desired, ultimately being removed and drained upon the syrup table. It is now dried in the shade, or in an evaporator, at a temperature not exceeding 100° Fahr. When the peel feels just a little moist to the touch, it is sprinkled with granulated sugar, and allowed to stand a few days before packing in boxes for the market. The resultant weight is about two-thirds of the original lemons before removing the pulp.

To make the Syrup.

Take the necessary sugar and water (about 3½ lb. sugar to 1 gallon of water), place in the cooking kettle and gradually warm. When the sugar is all dissolved bring to the boil, taking care to skim the surface, removing the froth and any dirt. Now test with saccharometer, allowing 3° for the hot

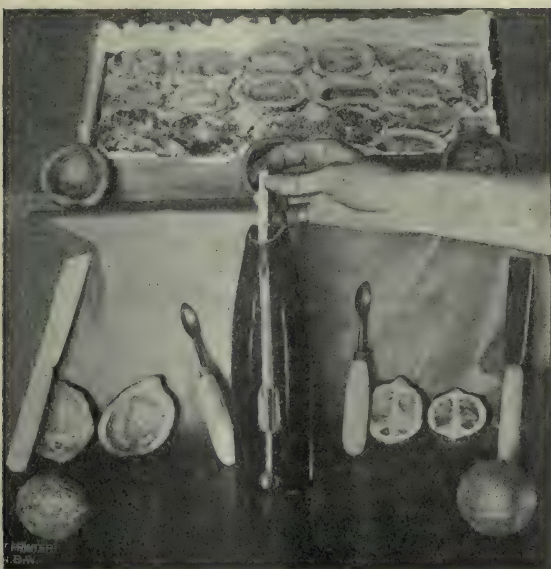


Fig. 4.—Candied Peel.
Showing saccharometer inserted in bottle with neck broken.

syrup. For instance, if the hot syrup denotes 15° Beaumé, when cold it will read about 18°. As was previously pointed out, the syrup loses its density, caused by the peel absorbing the sugar, and in return giving off its moisture, thereby reducing the density of the syrup. The required density is regained by boiling ; and when the right degree is arrived at the syrup may be used for a second batch of peel. This practice may be repeated until practically all the sugar in the syrup is absorbed by the peel.

As shown in Fig. 4, a long-necked bottle with the head broken off may be used as a make-shift for testing the density of the syrup.

Some authorities include 1 oz. of sulphate of soda to each 4 gallons of syrup to help prevent fermentation, and if the syrup should show signs of fermenting it must be drawn off the peel and reboiled.

After the first immersion in cold syrup, any future immersions may be made with the hot syrup and with the inside perforated covers over the peel, but hot syrup should never be poured over the peel unless the perforated covers are placed over it, else it will tend to make the top peel ragged, which greatly detracts from its appearance. (See inside perforated covers for glazed jars, Fig. 2.) The tops of the jars should not, however, be put on until the syrup has cooled, but any thin material may be stretched over same in the meantime to keep out dust and insects.

If peel is immersed in hot syrup at first, it will become hardened, as it will also do if the density is too great.

Packing.

The peel is packed in 7-lb. boxes, the boxes being lined with white paper, and the fruit neatly packed in layers. The box is constructed of light pine, sides, bottom, and top $\frac{3}{16}$ in., ends $\frac{1}{2}$ in. The inside measurement is 1 ft. $\frac{3}{4}$ in. x $6\frac{5}{8}$ in. x $4\frac{1}{8}$ in.

Cost.

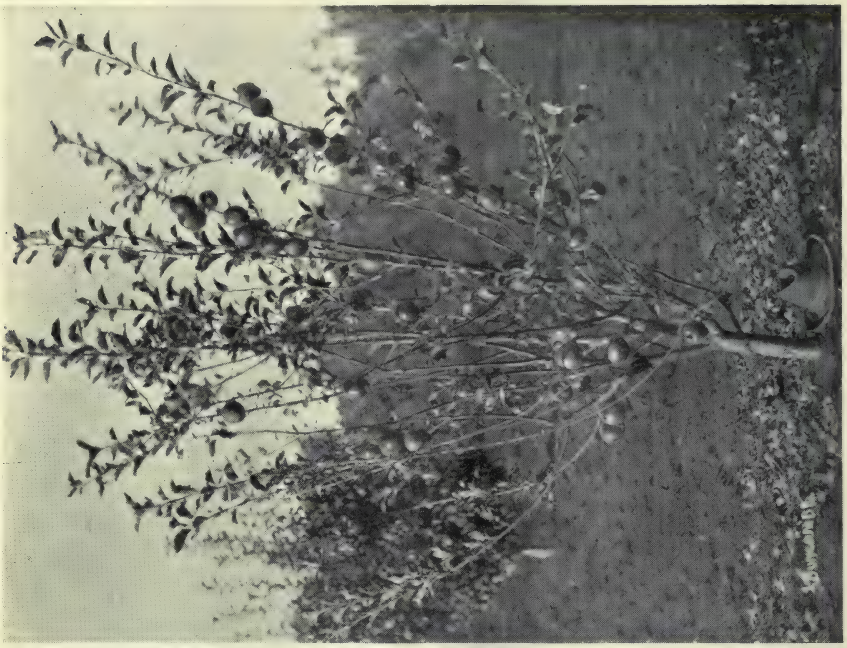
In handling only a small quantity the cost is comparatively much heavier than when a large bulk is treated, and many things must be taken into consideration, such as price of sugar, labour, &c. But as accurately as may be arrived at after handling only a small lot, the price estimated for sugar alone would be from 1d. to $1\frac{1}{2}$d. per lb. The first grade lemon peel brings on the market from $5\frac{1}{2}$d. to 6d. per lb.

It might be mentioned that when samples of peel candied by Mr. Allen and his assistants were exhibited at the Grocers' Exhibition in London, they attracted a great deal of attention, and were very highly spoken of. Representatives of several of the largest wholesale and retail handlers of dried peel, after very careful inspection of the samples, expressed a desire to place orders for the peel, and one buyer said his firm would be glad to secure a large parcel for trial. The opinion generally expressed was that in every respect the peel compared favourably with the best lines on the British market.

Fig. 1.—The Glen Innes Orchard.

A—Natural state of orchard site before the timber was felled.
B—A view of two rows of apple trees fifty-four months after planting.

a



b

Fig. 3.

Leaves removed from Buncombe apple trees, showing how and where the fruit hangs on pruned and unpruned trees.
a—Pruned, and *b*—unpruned, last winter. The pruned tree carried slightly more fruit.

Glen Innes Orchard.

W. J. ALLEN.

It was some time after the decision to establish an experiment farm at Glen Innes before it was definitely decided to start an orchard there. The soil and climate differed in almost every respect from that of the other Government farms, and after due consideration it was finally decided that a small experiment orchard should be established. It was not until early in 1904 that a start was made to clear the land, which was heavily-timbered country. (Fig. 1 A.) Part of the land is a light clayey loam, and the balance a rather heavy, dark clayey soil. A little basalt shows in one or two places, but the natural drainage is very poor. It was found that the soil held moisture almost too well, as wherever holes were made during the grubbing of trees, water would remain in them for weeks, hence the prospect of an orchard doing well on such soil was not particularly promising. The roots of the trees were run to a depth of 18 inches, and the land well subsoiled to that depth, after which it received a dressing of lime of 1 ton to the acre. The area set aside for orchard purposes was 24 acres, and this was enclosed with a good strong wire-netting fence, with two plain and a barbed wire above the netting. It was now secure against marsupials, &c., and in good condition for planting—if it can be considered that such new sour land is, so soon after clearing, in fit condition for receiving trees. The orchard was laid out and planted in August, 1904. The trees are 24 feet apart, and there is a good wind-break of Osage Orange. Next to this, and at a distance of about 12 feet, is planted a row of Pinus insignis and Oriental Planes, while still nearer the fruit trees is a row of Cedrus deodara and walnuts alternately on bottom and top, while at the two ends only Cedrus deodara are planted. The walnuts have not proved a success, while the majority of the Cedrus deodara have done fairly well (they are a slow-growing tree). The Oriental Planes, Pinus insignis and Osage Orange have made wonderful growth, the latter having made a beautiful man-proof hedge, while the Pinus insignis and Planes are from 15 to 20 feet high, and form a perfect wind-break.

The wind-break and headlands take up about 4 acres, leaving exactly 20 acres of trees and vines. There are in all about 500 varieties of the different fruits planted there, namely, almonds, apples, apricots, cherries, nuts, peaches, pears, plums, quinces, and grapes. We planted a good assortment of currants, gooseberries, and berries on the lighter soils, but as none of these proved profitable, we have uprooted the lot, and planted apples and pears in their place. Cherries have not been the success we hoped, and during the five years they have been growing on the lighter soils we have lost a large percentage from gumming. I feel quite satisfied that the soil is not suited for cherries, but that these, gooseberries, and currants require the red basalt country, on which they will thrive well and yield plentiful crops.

Pears and apples are doing remarkably well on both light and dark soils, and up to the present these fruits have more than fulfilled our expectations. From year to year since the orchard was planted, I have given pruning demonstrations, and explained my method of pruning. Some of the older growers have been rather sceptical about giving it a trial, but on the whole I have heard of very little adverse criticism, while the majority of those

a *b* *c*

Fig. 2.

a—Apple tree with leaves on.
b and *c*—Same tree before and after pruning.

interested in the work are trying to follow on the same lines. At the time of planting, the trees were well cut back, so as to form a low head, and at each succeeding pruning the centres have been well opened up, and the trees rather severely cut back and thinned out, until now I consider we have a well-shaped, sturdy lot of trees, second to none in Australia.

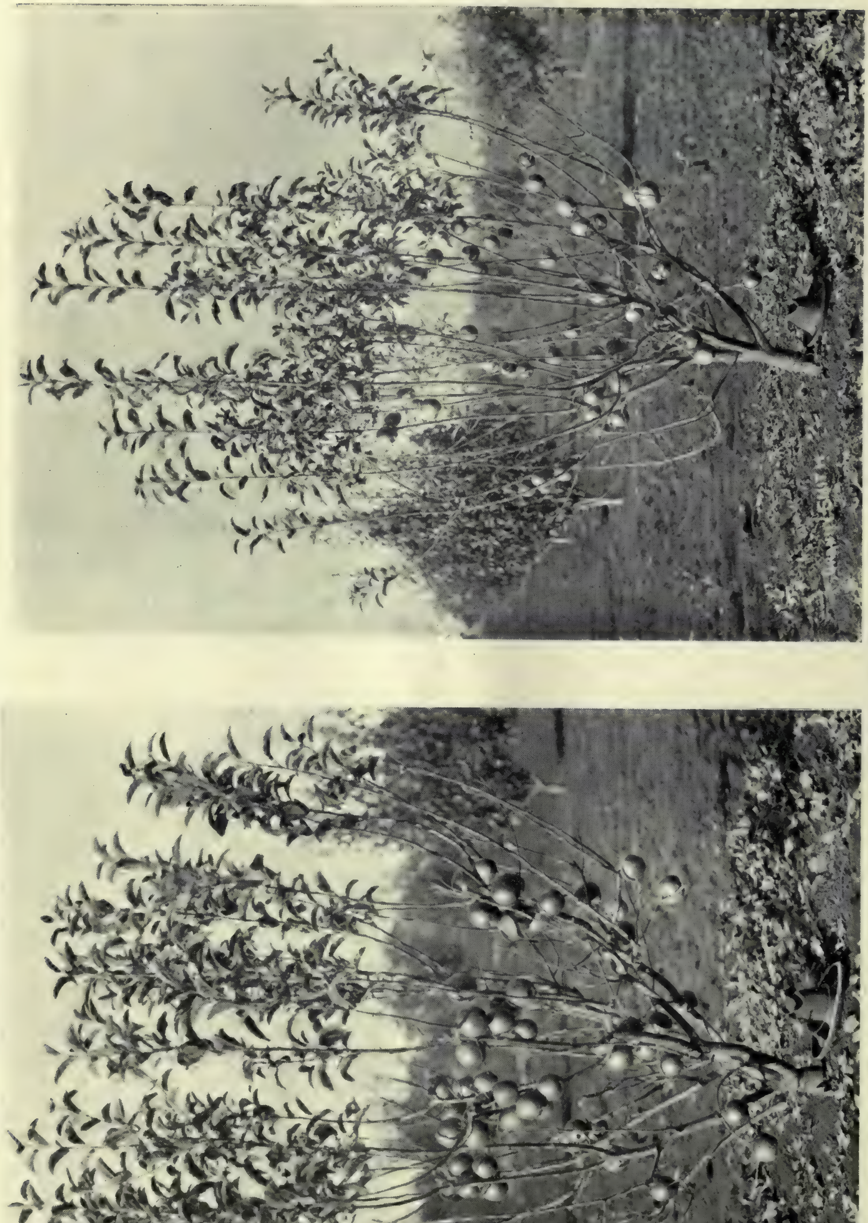
The second year after planting we harvested two apples, the third year about sixty, last year a good many cases, some of which were sent to the Franco-British Exhibition, where they were awarded the Grand Prix, and remained in splendid condition till 31st October; while this year the orchard will return somewhere about £80.

The man whom the Farm Manager (Mr. Gennys) gave me to do the work was formerly a shearer, and I do not think had ever been in an orchard

a *b*

Fig. 4.

a—Leaves removed from a Stone Pippin tree which has always been pruned.
b—Leaves removed from tree of same variety, which was left unpruned last winter.
Unlike the Buncombe, there is more fruit on the unpruned than on the pruned tree.



b

a

Fig. 5.

a—Pruned tree, Granny Smith variety, with leaves removed.
b—Unpruned tree, same variety, with leaves removed.

before. However, he is a very careful fellow, is very interested in his work, and has carried out instructions in a very satisfactory manner, until now he knows how to do almost any part of the work. I have always had him with me during the pruning of the trees, and can trust him with any part of the work. I mention this in order to show that any person who is careful, enthusiastic, and observant, can soon pick up this work if he will only apply himself. There is nothing from which more money can be made from a given area than fruit, provided good soil is chosen, and such fruits planted as are best adapted to the soil and district. Apples and pears are about the most profitable fruits to grow under present conditions in New South Wales.

I may add that after four years' pruning I have allowed two rows to remain unpruned as an object lesson, so that we may compare them with the pruned trees from year to year to demonstrate which will give the best results. We endeavour to give each variety of apple and pear the pruning found most suitable for that particular variety, and we have every confidence that we will be able to obtain considerable useful information about the many new varieties we have growing here, whether as to carrying quality, suitability for the district and export trade, and at the same time to demonstrate that this orchard can be made a success commercially.

At a meeting of fruit-growers and farmers, held at the farm in April last, I thought it best to remove the leaves from the trees shown, in order that the visitors might the more easily see just how much fruit there was on the trees, and on which part of the tree the fruit was borne. Those present were very interested, and expressed surprise at seeing such clusters of apples hanging throughout the centre of the trees. I secured photographs of typical trees, pruned and unpruned, of Buncombe, Stone Pippin, and Granny Smith varieties, which are reproduced in Figs. 3 *a* and *b*, 4 *a* and *b*, and 5 *a* and *b*.

Drainage.

At time of planting we anticipated that we would have to drain the whole of the orchard, and we are now making a start, draining the wetter portions first. In the meantime we have run surface drains to help carry away the surplus water, and have sunk a deep drain along the whole length of the orchard, at the bottom, into which the furrows empty, and which is large enough to carry a good head of water should at any time heavy falls occur.

Hailstorm.—Three seasons ago a severe hailstorm split the bark of the trees badly, cut off many of the leaves from the trees, and damaged the little fruit we had, but since then we have not sustained any further damage.

Farmers' Experiments.

South Coast District.

GEORGE VALDER, Chief Inspector.

As reported in the January number of the *Agricultural Gazette*, the principal crops experimented upon for spring sowing on the South Coast were forage plants, grasses, potatoes, and tobacco.

Forage Plants.

Plots were selected at the following places:—

Wollongong—Mr. L. Carr's farm.
Dapto—Mr. G. Lindsay's farm.
Albion Park—Mr. A. Wilson's farm.
Kiama—Mr. Theo. Grey's farm.
Berry—Government Stud Farm.
Nowra—Mr. H. McKenzie's farm.
Milton—Mr. J. Berry's farm.
Camden—Messrs. Porter Bros.' farm.
Moss Vale—Mr. J. Wallis's farm.
Kangaroo Valley—Agricultural Society (Mr. J. Chittick).
Robertson—Mr. W. Graham's farm.
Rooty Hill—Mr. E. F. Rudder's farm.

The plots varied in size from 4 up to 12 acres, and were divided into long narrow strips of equal size, and of about a quarter of an acre in area. It was found necessary to make them as small as this in order to obtain a fairly even block of land, as it was noticed it was almost impossible to get a large area of land in any of the coastal districts of sufficient evenness in quality.

The crops experimented with were maize, sorghum, millet, and cowpeas.

Maize.—Some difficulty was experienced in obtaining pure seed of good varieties of maize, but eventually supplies of the following were obtained:—Hickory King, Red Hogan, Yellow Dent, Iowa Silver Mine, Early Leaming, Golden Beauty, Riley's Favourite, Improved Gold Mine, and Pride of the North.

Sorghum.—The varieties tried were the three which appeared to be the favourites here, viz.:—Planter's Friend, Early Amber Cane, and Sorghum Saccharatum (black-seeded).

Millet.—Hungarian, Japanese, New Siberian, Red-seeded, White-seeded, and Grey-seeded.

Cowpeas.—Black, Clay-coloured, White, Whip-poor-will, and New Era.

Manurial trials as well as variety trials of maize and sorghum were made;

also mixtures of maize and cowpeas, and sorghum and cowpeas, were tried against maize and sorghum alone. Right along the South Coast the season proved to be an exceptionally dry one. Some few of the plots were complete failures, whilst others yielded a light crop, and only one or two gave results sufficiently good to obtain reliable data from.

The following were the results obtained at the Berry Farm:—

Variety trials of Maize.

YIELD of Green Fodder per acre.

	tons	cwt.	qrs.
Red Hogan	13	13	0
Yellow Dent	12	19	1
Hickory King	10	1	1
Improved Gold Mine	9	6	1
Golden Beauty	8	7	3
Early Leaming	7	2	3
Iowa Silver Mine	5	17	0

In all the other variety trials Red Hogan, Yellow Dent, and Hickory King stood out as being for the best varieties for green fodder and ensilage. Yellow Dent, although not quite equal to Red Hogan for yield, makes up for the shortage in being finer in the stalk—both valuable features from a dairy-farmer's point of view. The other varieties were all earlier and smaller growing ones, more suitable for inland centres than for the coastal districts. It was noticed, though, that the stronger-growing varieties, such as the three mentioned above, withstood the drought better than the smaller varieties; this is a point that growers in the dry districts should take note of.

Maize *v.* Maize and Cowpeas.

YIELD of Green Fodder per acre.

	tons	cwt.	qrs.
Hickory King maize	10	1	1
Hickory King maize and cowpeas	11	19	1

This shows a yield of nearly 2 tons more fodder per acre from the combination than from maize alone; besides this, we must remember that the combination is of much greater feeding value.

In the other trials, the average where fair crops were obtained was over 1 ton to the acre; but in several of the plots where the crops were very light the combination yielded less than maize alone. Still, the results, taken all through, speak volumes in favour of the combination, and I would strongly recommend dairy-farmers, when sowing maize or sorghum for green fodder, to try mixing cowpeas with them.

Manurial trials with Maize.

In the coastal districts, where the areas available for cultivation are small, it is generally recognised it pays to use fertilisers; but in order to try and obtain reliable data regarding the best fertilisers to use for such strong-

growing fodder crops as maize and sorghum, the Departmental Chemist (Mr. F. B. Guthrie) recommended the following:—

Fertilisers for Maize.

M 1.—
- 3 parts dried blood.
- 2 parts bonedust.
- 4 parts superphosphate.
- 1 part sulphate of potash.

M 2.—
- 2½ parts sulphate of ammonia.
- 6½ parts superphosphate.
- 1 part sulphate of potash.

M 3.—
- 2 parts bonedust.
- 2 parts sulphate of ammonia.
- 5 parts superphosphate.
- 1 part sulphate of potash.

M 4.—
- 1 part sulphate of ammonia.
- 7½ parts superphosphate.
- 1½ parts sulphate of potash.

M 1 is the fertiliser recommended by Mr. Guthrie in his article in the Bulletin No. 17, "Formulæ for Preparing Fertilisers," now obtainable, free, on application to the Under Secretary, Department of Agriculture, Sydney.

The season was so exceptionally dry that it was very unsatisfactory for such a trial. In the majority of cases the manure gave good results, but in one or two plots, where the yield was light, it seemed as if the unmanured plots gave as good, or even better, results than the manured ones.

The result of the trial at Berry Farm was as follows:—

YIELD of Green Fodder per acre.

	tons	cwt.	qrs.
M 1	10	0	2
M 2	8	0	2
M 3	7	16	1
M 4	6	2	3

Taking the results right through, M 1 stands easily first; but where the crop was light, M 4 ran it closely. The manure was applied at the rate of 1½ cwt. per acre, costing about 10s.

Variety trial of Sorghum.

In consequence of the dry weather, it was very late before the crops of sorghum were ready to cut, and even now some of the returns are not yet in. The average of those so far received is as follows:—

YIELD of Green Fodder per acre.

	tons	cwt.	qrs.
Amber Cane	7	4	1
Planter's Friend	5	12	1
Sorghum Saccharatum	5	2	3

Amber Cane withstood the dry weather better than the other two varieties, and being a quicker grower, soon showed out ahead. As a rule, dairy-farmers on the South Coast grow Planter's Friend, it being claimed that this variety will hold longer into the winter than any other crop. This is decidedly a strong point in its favour; but, instead of sowing all Planter's Friend, I would advise sowing Amber Cane for the early crops and Planter's Friend for late.

Sorghum *v.* Sorghum and Cowpeas.

YIELD of Green Fodder per acre.

	tons	cwt.	qrs.
Planter's Friend	5	12	1
Planter's Friend and Cowpeas ..	5	13	0

The average of all the crops shows practically no difference; but where the crops were fairly good, there was a decided difference in favour of the combination amounting to about 1 ton to the acre; on the other hand, where the crops were light the result was in favour of Sorghum alone. The evidence, on the whole, is, however, in favour of sowing the combination.

Millets.

The season was much too dry for the millet crops; most of the varieties came into seed when only about a foot high, and, therefore, they were either grazed off or ploughed in. At the Dapto plot, however, Hungarian Millet gave an excellent crop of green fodder, at a time when feed was very scarce, and, therefore, further experiments will be made with this and other somewhat similar varieties for catch crops during the coming season.

Cowpeas.

In consequence of the scarcity of seed, it was decided to allow most of the crops to mature their seed for use next season. Complete returns are not yet to hand, but from those so far received the Black and Clay-coloured varieties gave the best returns both of fodder and seed.

Cultivation.

One noticeable feature of the forage experiments on the South Coast was the very beneficial effect of thorough cultivation; wherever the land was well prepared and the soil between the drills kept well stirred, the crops withstood the drought very much better than where the cultivation was in any way neglected. At the Berry Farm, where the heaviest crops were obtained, the plots were treated in exactly the same manner as on the other plots, with the exception that the manager was very careful to see that the soil between the drills was well stirred whenever it was necessary. The land was not by any means a good piece; but owing solely to the extra cultivation given, good crops were obtained at a time when the crops on the other plots in the district failed.

The failure of some of the plots was undoubtedly due to this and to faulty preparation of the land. One difficulty is to get the plots ploughed up in good time. Many of the farmers wait until it is nearly time to sow before ploughing up their land for maize and sorghum, when, as a matter of fact, it is necessary to try and arrange to plough up the land months before, *i.e.*, to fallow in much the same way as our wheat farmers are now doing. Given moist seasons, late ploughing gives good results, but should the season prove a dry one, late ploughing is a fatal mistake. Of course, the trouble is that on the South Coast high prices for land and high rents make the

farmer anxious to get as much out of his cultivation areas as possible, and, therefore, many of them go in for continuous cropping. I have, however, noticed some cultivation lands left unploughed until the sowing season, whereas, had these lands been ploughed up as soon as the last crop came off, they would have benefited more by the spell and would have stored up moisture for the next crop. As a rule, also, it has been noticed that the maize and sorghum crops receive little cultivation—in many instances they are sown broadcast; whereas, were they sown in drills and the soil between the rows well stirred during the summer months, should the weather keep dry, they would yield better, and the fodder would be of better quality. In the past the rainfall on the South Coast districts has generally been ample for the production of good crops of fodder, and, therefore, rough methods of cultivation was all that it seemed necessary to give; but lately, owing to dry seasons, there has been a serious shortage of feed, and there can be no question but that better systems of cultivation must be adopted.

Potato Experiments.

In October last an experiment plot of an acre of potatoes was planted at each of the following places:—

Exeter	Mr. F. Jensen's farm.
Tenterfield	Mr. J. F. Chick's farm.
Orange	Mr. Geo. Worboys' farm.
Nowra	Mr. H. McKenzie's farm.

For each experiment land of even quality was selected, and this was divided into eight long strips of equal size. Each eighth of an acre was planted with a separate variety, 1 cwt. of seed being used, *i.e.*, at the rate of 8 cwt. per acre. Shirley's No. 5 manure was applied in the drills at the rate of 2 cwt. to the acre. Unfortunately, good seed of the best varieties was very scarce in consequence of the failure of the previous season's crop owing to dry weather. Therefore we were not able to send the same varieties to all the farms; the comparison at the four plots had to be limited to five varieties. The result was as follows:—

	Exeter.	Tenterfield.	Orange.	Nowra.	Average yield per acre.
	Per acre.	Per acre.	Per acre.	Per acre.	
	t. c. qr.	t. c. qr.	t. c. qr.	t. c. qr.	t. c. qr.
Brownell's Beauty ...	1 17 0	5 13 1	2 9 0	3 4 1	3 5 3
Cambridge Kidney ...	1 14 0	4 13 1	3 15 0	3 7 3	3 7 2
Early Rose	1 2 3	6 2 3	3 5 0	3 8 1	3 9 3
Manhattan	3 19 0	5 13 3	2 9 2	3 14 3	3 19 1
Southern Star	1 11 0	5 1 1	2 19 2	3 13 3	3 6 1
Magnum Bonum... ...	....	4 10 2	3 1 1	3 11 0	....
Snowflake...	1 11 0	6 5 3	....	4 3 0	....
Up-to-date	1 14 0	....	....	2 3 2	....
Breese's Prolific	....	4 16 1	....	....	....
Carmen	....	....	2 3 0	....	....
Improved Early Rose ...	....	....	2 15 2	....	....

Both at Tenterfield and Nowra, Snowflake gave the heaviest yields, but it was noticed that the tubers were rather small for market purposes. Also the Tenterfield experimenter reported that it was not a good variety for market on account of its white skin, brown or red skinned varieties being much preferred.

At Exeter, Manhattan gave by far the best results, and it will be seen that it comes very high in the average of the four plots. It was reported that it proved a good dry season variety, although it may be said that being a later variety than most of the others it benefited more by the late rains.

At Orange, Cambridge Kidney came first, and like Manhattan it gave a good all-round return. The old favourites, Early Rose and Brownell's Beauty, also gave good results, yielding even crops of good marketable potatoes.

This season arrangements are being made to extend the potato experiments, there being a better supply of seed available.

Top-dressing Grasses.

In view of the reported success of top-dressing pastures with superphosphate in Victoria and South Australia, it was decided to carry out some trials with fertilisers on South Coast pastures, especially those which showed signs of wearing.

Besides superphosphate, the mixture recommended in Bulletin No. 17 by Mr. Guthrie, in his article on "Fertilisers for Pastures," was tried. This mixture is as follows:—

4 parts sulphate of ammonia.
4½ ,, superphosphate.
1½ ,, sulphate potash.

Three plots of an acre each were laid out on the following plan:—

Area—1 acre. Superphosphate, 2 cwt., cost 9s. Harrowed.
Area—1 acre. No manure. Harrowed.
Area—1 acre. Grass Mixture, 1 cwt., cost 10s. Harrowed.

It will be seen that the area occupied by the experiment is 3 acres; when 4 acres or more was available, a fourth plot was pegged off, which was left untouched. This was done in order to compare it with the centre acre, which was harrowed, but not manured.

Plots similar to this plan were laid out at Wollongong, Dapto (three plots), Albion Park (two plots), Kiama (two plots), Berry, Nowra, Milton, Moruya, Kangaroo Valley, Robertson, Moss Vale, Camden, and Rooty Hill. Also

the following Camden farmers—Messrs. F. W. Downes, P. A. L. Bennett, P. Crossing, W. G. Watson, T. C. Barker, and the Camden Park Estate, and Mr. F. Moore, of Campbelltown—offered to carry out a similar experiment, at their own expense, under the direction of an inspector, and this offer was accepted. Most of the plots were top-dressed in September and October, but the Camden Park experiments were not started till December.

The season proved to be a very unsuitable one for this experiment also, as, although the application of the manures to the various plots was spread out over three months, no rains fell which were likely to bring out the effects of the manure to any extent.

It was reported that on some of the plots, a few weeks after the dressing was applied, there was a marked difference in colour between the plot treated with the mixture and the other two, the grass on the former being of a darker green. This was, no doubt, due to the action of the sulphate of ammonia. The plots treated with superphosphate showed no beneficial effects at first, but later in the season it was reported that the clover grew more strongly on these than on the other plots.

The experiments will be continued shortly, it being desirable to try the effect of applying the manures earlier in the season, say during July and August. The plots already treated will be redressed, and other fertilisers will be tried. Most of the experimenters wished to have the experiment tried again, as they stated they considered the season was a dry one, and that the manures did not get a chance.

Tobacco Seed for Distribution.

Last year the Department imported from America nine selected varieties of tobacco seed, and this was distributed to applicants from all parts of the State, some 295 packets being sent out. Reports of these trials are coming to hand, and a summary will be published in the next number of the *Agricultural Gazette*.

Another consignment of fresh seed has just been received from America, and this will now be available for distribution. The varieties are as follow :—

Pipe Varieties—

Bonanza.	White Stem Oronoko.
Gold Finder.	Slate's Improved White Stem Oronoko.
Slate's Improved Gold Leaf.	Warne.
Raglan's Conqueror.	Yellow Oronoko.

Cigar Varieties—

Connecticut Seed Leaf.	Slate's Improved Connecticut Seed Leaf.

Applications for seed should be made to the Under Secretary, Department of Agriculture, Sydney.

From the reports received regarding last year's trials, it appears that many of the experimenters were too late in sowing, and, therefore, the Department would be glad if those who do intend to apply would do so early in order that the seed may be sown in good time.

Trial of Argentine Wheats.

In 1906 samples of six varieties of wheat—Russian, Barletta, Chubert, Hungarian, Lombard, and French—were obtained by Mr. Cherry through Mr. R. Jeckeln, of the Consulate-General for the Argentine Republic, for trial in this State. The wheats were received in August, so that they had to be sown very late the first season (1906), and, so far as growth was concerned, a fair test could not be made, but sufficient evidence was obtained to show that the varieties were all very liable to rust.

During 1907 dry conditions prevailed, and a good opportunity occurred to study their drought-resistant powers. Chubert and Lombard (bearded) gave fairly good results, but the other varieties were poor. "French" was discarded altogether.

In January, 1909, the Experimentalist at the Hawkesbury Agricultural College reported that after further trial he had formed the opinion that none of the varieties under trial were equal to our own varieties, such as Bobs, Federation, and others, in respect of yield of grain; and as three of them—Lombard, Barletta, and Hungarian—were bearded, they could not be taken into consideration as desirable for haymaking. They appeared, however, to be good milling wheats, and to determine this point samples were submitted to the Chemist for test in the Departmental mill.

Mr. Guthrie reported as follows:—

Russian Variety.—A bright red, small, plump, fairly hard grain, going 64 lb. to the bushel. Fairly easy to mill; yielding 70 per cent. flour, 13·9 per cent. pollard, and 16·1 per cent. bran. The percentage of dry gluten was 18·8, and flour strength 48·4 per cent.

Note.—This is probably the best milling sample of the five varieties. The flour yield is satisfactory. It is a good-looking wheat, of good bushel weight. The colour of the flour is first-class, the gluten content remarkably high, and it is of medium strength.

Chubert Variety.—A dark brown, medium size, fairly plump grain, going 64¼ lb. to the bushel. Fairly easy to mill; yielding 67·4 per cent. flour, 16·2 per cent. pollard, and 16·4 per cent. bran. The percentage of dry gluten is 14·07, and flour strength 48·4.

Note.—A fair milling wheat. Flour yield low; colour of flour rather starchy; strength medium, and gluten high.

Lombard Variety.—A brown, long, large, fairly plump and hard grain, going 62¾ lb. to the bushel. Fairly easy to mill; yielding 66·1 per cent. flour, 16·6 per cent. pollard, and 17·3 per cent. bran. The percentage of dry gluten is 15·3, and flour strength 45·6.

Note.—Not a good milling wheat. Flour yield low; colour of flour only fair, and strength low, despite very high gluten content.

Hungarian Variety.—A dark brown, plump, fairly long, medium hard grain, going 63¼ lb. to the bushel. Fairly easy to mill; yielding 67 per cent. flour, 18·4 per cent. pollard, and 14·6 per cent. bran. The percentage of dry gluten is 14·6, and flour strength 46.

Note.—The yield of flour in this sample is rather low and the flour is of low strength, otherwise satisfactory, the colour being a little inferior to the Barletta; gluten high.

Barletta Variety.—A dark-red, fairly plump, medium-sized, soft grain, going 64 lb. to the bushel. Fairly easy to mill; yielding 67 per cent. flour, 17·2 per cent. pollard, and 15·8 per cent. bran. The percentage of dry gluten is 17·2, and flour strength 49·6.

Note.—This is, in all respects, a good milling sample, with the exception that the proportion of flour obtained is rather low. In colour the flour is the best in the batch; it is extremely high in gluten, and of fair strength.

This season extended trials of these wheats are being made at Cowra Experiment Farm.

The Champion Wheat of Manitoba.

Great efforts are being made to advance the wheat production in Western Canada, and each year the provincial governments arrange seed fairs throughout the provinces of Manitoba, Saskatchewan, and Alberta, which comprise Canada's premier wheat territory. At the local fairs the seed is adjudicated upon, and addresses on seed improvement are delivered by experts. After the local seed fairs have all been held, a Central Provincial Seed Fair takes place, at which are exhibited all the prize-winning samples from the local exhibitions.

This year Messrs. Bulman Bros., the publishers of *Farm Crops*, with the object of encouraging the production of the best seed, donated prizes; and these gentlemen have been good enough to forward to the Department of Agriculture a small sample of the Manitoba wheat which was awarded the championship prize.

The wheat is of Red Fife variety, which is so well known in European markets as No. 1 Hard.

The seed has been placed in the hands of Mr. Sutton, Wheat Experimentalist, for trial at the Cowra Experiment Farm, and the results will be published. It may be several seasons, however, before any definite opinion can be formed as to the suitability of the variety for our conditions.

Argentine Lucerne Seed.

C. T. MUSSON, Hawkesbury Agricultural College.

RECENTLY a sample of lucerne seed, grown in the province of Mendoza, Argentine, was sent to this College for trial in comparison with Australian-grown seed.

It was submitted to this section for investigation as to purity and germinating capacity, and more especially to see if Dodder or other detrimental weeds were present, with the following result:—

Appearance.—Very variable in colour, more so than usual, by reason of there being present numbers of very dark, old, much shrivelled seed; some broken seed; fresh looking; apparently saved dry.

Size.—Variable, as is usual.

Composition.—Of true lucerne seed, 98·8 per cent. by weight; of weed seeds and refuse, 1·2 per cent. by weight.

Germinating Capacity.—Of 100 good seeds, 79·7 per cent. germinated in six days. Of the balance, 12 per cent. were "hard" seeds, at least half of which would probably have germinated later; these have been omitted altogether from the calculations, as their very late germination in the field would render them practically useless.

Real Value.—Our standard is 98 purity $\times$ 85 germination $\div$ 100 = 83 per cent., whereas this sample gives 79·7 $\times$ 98·8 $\div$ 100 = 78 per cent.

Allowing 5 per cent. as the maximum margin, this seed would pass the test for "real value." This means that for every 100 shillings paid for seed we only expect to get 83 per cent. "good," whilst we might get up to 90 per cent.; but in the seed under consideration we only get 78. Put in another way, 100 lb. seed at 1s. a lb. only giving 83 per cent. "good," really costs nearly 1s. 2½d. per lb. for the live seed—that is, such as will grow; whilst this Argentine lucerne would cost nearly 1s. 3½d.

When sowing any considerable area, therefore, it is important that we should know the germinating power and purity of the seed to be used, in order that due allowance may be made for failures. A man intending to plant at a given rate in lb. per acre, if using seed only showing real value 78, though expecting all his seed to be good, would seed at only three-fourths the intended quantity—a matter of some considerable importance. For every 100 lb. good seed he wanted to sow he would need to sow 122 lb. Naturally, if he bought it on the known vitality of the seed, price would doubtless be in accordance with quality.

It would appear that this points to the necessity for knowing the germinating capacity and purity of value when purchasing. If such facts were asked for, the seedsmen would arrange to supply them.

Remarks.

This is a fair sample of seed so far as germinating capacity is concerned, returning 79·7 per cent., as against an average of 74·5 for fifteen samples tested during the last eight years.

As regards "purity," it is the worst sample we have ever examined. Whilst within the standard (98 per cent.), containing only 1·2 per cent. of weed seeds and rubbish, this amount is far more than we usually find. It is most exceptional to find even ¼ per cent. of weeds and rubbish in Hunter River or Tamworth seed, and in most cases weed seeds are totally absent.

Amongst the seventeen different species of weed seeds we can recognise are:—

Three grasses.	A labiate.
Two salsolaceous plants (Fat Hen).	An umbellifer (like Hemlock).
One amarantus (like Red Leg).	A dock (Rumex).
Corn Bindweed.	A vetch (Vicia).
Plantain, or Lamb's Tongue.	A crucifer (like Charlock).
Two thistles.	

These are being grown for accurate identification. There is nothing exceptional or dangerous in the way of weeds amongst them, though most of them would be unwelcome visitors. There was no dodder present.

Other features worth noting are,—the presence of mouse-dung, and the presence of a chalcid wasp, which is evidently identical with the insect that the Entomologist, in last issue of the *Gazette*, reported as a new and serious lucerne pest in Tamworth district.

It might be added that the testing of farm seeds of all kinds, whether from local or oversea sources, is a matter of general routine at the Hawkesbury Agricultural College, and all students participate in the work in order to gain a practical insight into the methods of distinguishing between good seed and unsound or weed-infested seed.

Farmers having any doubt as to their seed are invited to submit samples (about ½ lb. is sufficient) to the Department of Agriculture for test, in the same manner as the lucerne seed under review. After one has gone to all the expense and trouble of preparing an area for cropping it is little short of madness to sow inferior seed, which may not only fail to grow at all, but introduce weeds that will take years of persistent labour and expense to eradicate. In permanent crops, like lucerne, this danger is even more pronounced, and it is therefore hoped agriculturists will not hesitate to avail themselves of the facilities that are placed at their disposal free of cost.

Adulterated Chaff.

Complaints have been rife for some time in regard to the importation from Victoria of large quantities of adulterated chaff, that is to say, of a little of the prime cuts intermixed with a lot of rubbish. Last Tuesday 47,000 bags arrived in Sydney in three steamers from Victoria. The new Victorian Act forbidding the sale of adulterated chaff comes in force on 1st July. Hence this undesirable dumping in Sydney. The Sydney agents contemplate taking drastic action.—*Evening News* of 3rd June, 1909.

The intermixture of inferior, damaged, and perhaps, harmful materials, with oaten or wheaten chaff is a mean form of swindling, which can best be

checked by buyers placing themselves in a position to know the difference between a sample of sound wholesome chaff and a sample in which inferior rubbish has been cunningly mixed.

It is one of the first aims of the Minister of Agriculture to assist all concerned in the detection of adulteration in manures, seeds, fodders, &c., and any samples submitted to the Department will be promptly investigated and reported upon free of charge.

Mr. Perry says it may be of interest to mention that at the Hawkesbury Agricultural College every student is trained in the judging of all kinds of produce and live stock, and in the matter of chaff the following points from the score cards prepared for the use of students will afford some idea of the scope of the inquiry that the student is trained to make in forming his opinion as to the value of a sample of chaff.

STUDENTS' SCORE CARD.

OATEN AND WHEATEN CHAFF.

Scale of Points.	Maximum Points.	Students' Estimate.	Instructors' Estimate.
1. Colour—bright green preferred (according to marked requirements).	12	....	....
2. Smell—fresh, sweet, appetising; free from mustiness.	20	....	....
3. Length and cleanness of cut	16	....	....
4. Fineness and softness of stem...	10	....	....
5. Amount and condition of grain (ripeness according to market requirements).	8	....	....
6. Proportion of stem to leaf	8	....	....
7. Cleanness—freedom from dust, moulds, and impurities.	16	....	....
8. Weight and general make-up for market	10	....	....
Total	100	....	....

No. of Sample.....................
Name of Student................ Variety.................
Date..................................

A similar card, with appropriate headings, is used in the case of lucerne chaff.

The samples which are utilised for the purpose of investigation are purchased in the open market in Sydney, so that the students may gain a fairly wide experience of the various classes of fodder that come from local and Interstate sources.

It will be noted that special attention is devoted to the question of freedom from dust, moulds, and impurities, and in investigation of these points the student is compelled to exercise to the fullest extent the knowledge he has acquired in the laboratory.

Where any feature likely to be detrimental to the health of animals is discovered the students have the benefit of the expert advice of the College Veterinary Surgeon.

Inoculation and Lime as Factors in growing Lucerne.

In practically every farming district of New South Wales, whenever an abnormally high value is placed upon land, it is because the soil is suitable for lucerne. Every settler cannot afford to pay what he may regard as a fancy price for good lucerne land, but every stock farmer at all events knows that it is an enormous advantage to be able to grow lucerne, and it will be of interest to those who have hitherto failed to get satisfactory results with this crop to learn that experiments made in the United States, where lucerne is justly regarded as the king of fodders, point to the possibility of successful results being obtained by the use of lime and inoculation of the soil.

The experiments now referred to have extended over several seasons, and have been carried out on over a hundred farms in various parts of the State of New York, where the successful growth of some prolific, nutritious and easily-conserved crop like lucerne (or alfalfa, as it is called in America) is a matter of paramount importance, in view of the severity of a long winter. Many farmers in New York State, and indeed throughout the United States, felt just as many farmers in New South Wales do, that it would be of enormous benefit to them to have a nice patch of lucerne; but they refrained from attempting to grow this crop, simply because an unsatisfactory trial, either on their own land or on the farm of a neighbour with similar soil, had led them to believe that it was hopeless. The object of the New York State experiments was to find out whether, by means of liming the soil or by inoculation (*i.e.*, introducing to it bacteria found in soils in which lucerne grows well and produces nodules on its roots), the hopeless areas could be converted into productive ones. In summarising the results from the 100 experiments already referred to, Messrs. Harding and Wilson, Bacteriologists of the Experiment Station Staff, state that where neither lime nor inoculation is applied the chance of a successful crop of lucerne is not more than 1 in 5. Where lime is added to the land at the rate of 1,500 lb. per acre, the chance of success is raised to 2 in 5. Where inoculation is carried out alone, at the rate of 200 to 300 lb. per acre of soil from a place where lucerne is growing successfully, the chance of success is about 3 in 5. Where both lime and inoculation are applied as above indicated, the chance of a successful crop is raised to about 4 in 5. Messrs. Harding and Wilson add that, in considering the practical bearing of these results, the fact must be constantly borne in mind that while the land upon which their experiments were conducted has been selected by the farmers, they have been urged to select land which was well drained and of a fair degree of fertility, and to exercise great care in freeing the land from weeds before sowing the lucerne. They were also urged to send samples of their seed to the station for examination for dodder, trefoil, and injurious weeds.

In view of the uniform character of the results of the experiments, there can be no doubt but that, when the above conditions are observed, the natural lack of inoculation and of lime in the fields of this State (New York) is responsible for the larger part of the difficulty which has been experienced in the establishment of lucerne.

Of these two, the lack of lime is the more common, since practically all the soils respond to its application. However, the lack of inoculation is more often the controlling factor, and the application of soil containing the essential bacteria changed about twice as many fields from failure to a success as did the application of lime.

It should be kept in mind that, when sufficient inoculation is already present in the soil, the addition of more is without any apparent effect on the crop. When sufficient inoculation is not present, the application of 150 lb. to 300 lb. of soil from a lucerne area on which the plants are well provided with nodules will supply the necessary bacteria.

The application of inoculation or of lime will ensure a crop of lucerne only in so far as these are the only things which are lacking in that particular field. Good results cannot be expected unless the land is well drained, of a reasonable degree of fertility, and is so prepared for the crop as to destroy the maximum number of weed seeds and properly fit the land for the seed. When, in addition to these things, the seed is good, and free from dodder and objectionable weed seeds, the farmer is ready to test the need for inoculation and of lime on the particular area where he later hopes to produce lucerne in large quantities. The quickest and most economical method of finding the need of his soil with regard to inoculation and lime is to restrict his sowing to a single acre, and lay out that acre thus :—

No lime ; no inoculation.	Lime ; no inoculation.
No lime ; inoculation.	Lime and inoculation.

Down-hill side of area.

It will be observed that this provides for a test of the effect of inoculation and of lime separately and in combination, and reserves one-quarter of the area untreated as a check or basis for measuring the effect produced. The lime was applied some days before the sowing of the seed, and well watered into the soil.

The inoculating soil was obtained from a field at the New York Experiment Station, and was applied broadcast at the rate of 200 lb. to 300 lb. per acre just before sowing the seed. Thus the harrowing which covered the

seed mixed it at the same time with the inoculating material. For the two inoculated blocks, the lower side of the area was chosen, to prevent any washing of inoculated material on to the untreated plots. Likewise, in putting in the seed, it was necessary to sow and harrow the inoculated half of the field first to avoid spreading the inoculation by means of the machinery.

From an acre laid out in this way, any farmer can see for himself just how his soil responds to this line of treatment; and this form of experiment is recommended to all who are beginning to grow lucerne. Of course, it must not be forgotten that in New South Wales there are to be found on many farms two or more classes of soil; but it is assumed that when the growth of lucerne is contemplated, the class of soil that is possessed of the best natural drainage and other features that are favourable to the establishment of a permanent crop would be selected.

As mentioned in last issue of the *Gazette*, the question of soil inoculation has for a long time engaged the attention of the Department of Agriculture; and the Director of the Bureau of Microbiology, Dr. Tidswell, in conjunction with Mr. H. W. Potts, Principal of the Hawkesbury Agricultural College, commenced this season at Richmond a series of field experiments in further investigation of matters he has already determined in the laboratory. Dr. Tidswell and Mr. Potts have also laid out areas at the College farm on precisely the same lines as have proved so conclusive in the United States, and it is felt that the results of these experiments, when available, will be of interest and material benefit to intending lucerne-growers. Similar experiments are also being undertaken at the other experiment farms of the Department.

Farmers desirous of conducting similar experiments on their own account may obtain cultures of the bacteria from the Director of the Bureau of Microbiology, Sydney, if there is not available in their neighbourhood an area of well-established lucerne from which soil suitable for inoculating purposes may be obtained. If samples of soil from a lucerne paddock are submitted to the Bureau of Microbiology, the Director will be only too pleased to have it examined to ascertain if the necessary bacteria are present in it.

The Argentine Rural Society.

The Hon. the Minister of Agriculture is notified that the Argentine Rural Society celebrates, on 3rd June next year, at Buenos Ayres, an International Pastoral and Agricultural Exhibition.

Sheep exhibited, in groups of three, merinos and similar breeds such as Corriedales, must be properly shorn first to third day of December; shearing of black-face breeds optional.

Programme and regulations will be forwarded shortly to the Argentine Consulates in Sydney and Newcastle, where intending exhibitors may obtain full particulars.

The Pilliga Scrub.

W. R. FRY, Acting Inspector.

THE development and permanent settlement of that tract of country known as the Pilliga Scrub has received the attention and earnest consideration of practical men for many years.

These practically vacant lands, comprising 1,800,000 acres, are situated between the Namoi and Castlereagh Rivers, and front the North-western Railway from Baan Baa to beyond Wee Waa. Most of it has been under pastoral occupation at some time or other, chiefly for cattle, but so far no form of tenure has attracted permanent settlement.

The Department of Lands is now trying a new system of inducing settlement by means of which the blocks are partially improved before selection. Last year twelve blocks were made available in the vicinity of Yarrie Lake, at a low capital value (about 6s. 8d. per acre), and the settlers appear to be satisfied with the class of country. An additional area, consisting of twenty portions of about 1,000 acres each, has also been surveyed for conditional purchase lease, and will be available very shortly. On each of these blocks 250 acres are being improved; on some the timber is pulled down, on others it is charred and burnt off, and on some an area is made ready for the stump-jump plough. The capital value will probably be fixed very low to attract settlement, and the cost of improving the 250 acres will be added to the total value of the whole block. Five of these blocks face Bohemia Creek, in which water is permanent under the sand; and four front the railway line, being distant about 9 miles from Narrabri.

Most of the surrounding settlers are purely graziers, and very little attempt at systematic agriculture has yet been made. In order to obtain accurate local information of the agricultural potentialities of the land, the Department of Agriculture has arranged with settlers on the fringe and in different parts of the scrub to conduct field trials with various crops and methods.

Experiment plots, comprising manurial tests and trials of several varieties of wheat, have been sown on the red soil at Wee Waa, and on the poorer sandy soil near Narrabri. Another plot, consisting of six varieties of wheat, has been sown for hay, on the opposite side of the scrub, near Baradine, which locality is rather far from a railway for profitable grain production.

The following notes are the outcome of a personal inspection of the sites offered for experiment purposes, combined with the information derived from District Surveyors and existing settlers, and supported by the writer's agricultural experience during four years' residence in the north-western district. They are offered as suggestions as to the methods that should be practised by settlers to obtain profitable results, until more detailed reports of the field experiments shall be available.

The nearest important town is Narrabri, as the town of Pilliga, from which the scrub derives its name, is now practically dead, except for the timber industry. Formerly it was the busy centre of the Namoi pastoral district, but now its sandy main streets are overgrown with couch grass.

Timber.

The Pilliga Scrub is not dense like that of the northern rivers, but generally is open underneath, and the soil frequently is bare of grass and herbage owing to the devastation of rabbits. The growth of the indigenous timbers serves well as a guide to the character of the soil. For example, the sand ridges generally grow dense pine scrub; the red loamy soil produces open forest, timbered with box and rosewood, with heath and cotton-bush on the scalded patches; whilst the stronger black soil is covered with dense belah scrub, or brigalow and wilga, and is frequently "melon" or "crab holey." The poorest country is timbered with white gum and bloodwood, and is practically unimprovable, for, if ringbarked, the bloodwood suckers badly from the roots. There is still plenty of good pine (*Callitris sp.*) in the centre of the scrub, but the best ironbark is becoming scarcer. One local contractor has an order to supply 40,000 sleepers, and as many of these have to be carted a distance of 30 miles, it will easily be seen that the supply will soon be exhausted. Settlers will be able to obtain abundance of straight pine logs for all kinds of sheds, barns, corncribs, dog-proof fences, yards, and general purposes; but if they desire to sell any of it, a license will be necessary, and a royalty paid on all logs delivered at the mill. Wire-netting can also be obtained on easy terms from the Crown through the Pastures Protection Board, repayments being spread over a number of years, with interest of 4 per cent. on balance due.

Clearing.

The best method is to ringbark first, as the land then becomes sweetened. Ringbarking costs from 2s. per acre, and the best class of this country can be burnt off in two years time at an additional cost of 8s. to 10s. per acre. The dense belah timber will burn away to a white ash, but the brigalow is difficult to deal with owing to its suckering proclivities. There is a difference of opinion amongst local people as to the best time for ringbarking, but, at any rate, the brigalow country is better ploughed as soon as the trees are ringbarked or cut down; for if the suckers are allowed to grow for a year or so they become too thick and strong for the disc plough to operate on. In the case of box timber, which burns well, the trees are more quickly killed by "fire charring" than by ringbarking. This practice consists of opening up the soil around the roots (after rain when land is easily worked) and piling dead timber around to fire-ring or "char" the trunk and tap-root. If thoroughly done the fire causes such a shock to the tree that it seldom suckers again. The contractor who is clearing the land for the Crown has utilised traction engines for pulling down the trees, and the work appears to be satisfactory as long as the ground is soft and the land ploughed before the suckers have time to grow. On ringbarked land settlers can economically utilise bullocks or horses to pull down the dead trees.

Water Supply.

The southern portion of the scrub is intercepted by numerous gullies and creeks, not more than 2 to 3 miles apart, in which water can always be obtained by sinking in the sand. Towards the Namoi, however, the creeks are farther apart, but water can be obtained by sinking to a depth of about 120 feet. Four wells have been sunk already by the Crown for the use of future settlers. A portion of the scrub also overlies the artesian basin, as proved by the Pilliga Bore, and the sinking of additional bores is being considered. Good tank sites can also be chosen in places, as old tracks crossing scalded plains afford splendid catchment drains.

The climate is healthy and the children appear strong and wiry. The summer temperature is certainly high, but being a dry heat is not so enervating as that of the moist coastal districts.

The average rainfall at Narrabri for over a period of thirty-three years has been 26 inches, the greatest falls being during January, February, or March, when the monsoonal rains extend southwards from Queensland. It might be noted that, under ordinary conditions, these summer rains are of no use to the wheat crop, but, when falling on *fallowed land*, create a splendid reservoir for early sown crops. The following table, supplied by the Government Meteorological Department, showing the average rainfall at towns in or around the Scrub as compared with other wheat-growing districts, is well worth perusal:—

Rainfall of Towns in or around Pilliga Scrub.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly Average.
Gunnedah ...	229	246	264	175	189	169	149	217	190	213	199	248	24·88
Boggabri ..	219	238	245	126	179	187	149	194	156	193	185	201	22·72
Narrabri ..	283	297	256	184	221	209	177	174	183	192	225	199	26·00
Wee Waa ...	260	231	234	163	202	198	168	171	160	181	180	164	23·12
Pilliga	218	219	175	152	206	162	146	152	138	154	139	153	20·14
Coonabarabran	284	333	315	273	286	230	191	246	215	225	201	241	30·40
Baradine ...	228	219	205	205	244	213	178	194	146	172	173	177	23·84

Rainfall of Wheat-growing areas of the State.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly Average.
Junee	158	122	184	167	170	234	178	184	191	206	144	140	20·78
Wagga	155	139	185	185	199	274	185	197	183	222	166	126	22·16
Narrandera ...	153	117	157	161	155	200	158	164	138	179	124	92	17·98
Coolamon ...	151	129	189	181	171	237	198	178	162	197	129	108	20·30
Temora ...	164	103	153	157	150	212	166	169	163	210	167	156	19·70

It is evident that the Pilliga Scrub is generally unsuitable for sheep grazing except as temporary relief country during drought. Some local people state that the sheep left in the scrub soon become wormy, whilst there is no doubt of the injurious effect of the grass seed. The writer saw some mutton from sheep killed there which was quite riddled with grass seeds, the sharp awns having penetrated right through the fleece and skin into the flesh. Much of the land is, however, well suited for wheat-farming,

it being estimated that 1,200,000 acres will prove suitable for wheat when cleared. Splendid samples of wheat have been grown in the scrub around Wee Waa, in which locality the soil is equal to some of the best wheat lands around Coolamon. The sandy loams are easily worked, and ploughing can be done at almost any time without waiting for rain. For the first few years settlers will naturally crop the same land each season, but, as the cultivation area becomes extended arrangements should be made to leave a part, say, at least 100 acres, *fallow*—that is, a certain proportion of the arable land should not be sown with wheat every year but ploughed up early for the next season's crop. Under ordinary conditions the stubble cannot be cleared off in time for early ploughing—say, January—unless *burnt off*. The practice of *burning off* the straw, however, is to be deprecated, especially on the sandy soil, which by such method soon becomes depleted of humus or vegetable matter and thereby loses its power to resist dry spells. The straw is better fed off and trampled down, or disced up with a little rape seed and fed off in winter, and the land then deeply ploughed after the sowing of the main crop has been completed. Rape for fodder purposes has been grown successfully in these soils. From experience at Moree it is recommended that the black clay soil when fallowed should be turned up and left very rough and cloddy. The "roly-poly" and other weeds will not grow so much on cloddy ground until it becomes weathered down. After the monsoonal rains, generally in February, the land should be occasionally cultivated to kill weeds, check evaporation, and prepare a fine seed-bed for the wheat which can be sown in April. By this practice the crop has the benefit of a great proportion of any rain that may have fallen *three to four months previous to sowing*. Such a system is gradually becoming recognised as the sound business method of farming in a dry district, as distinct from the ordinary practice of merely scratching in the crop with a cultivator late in the season and letting it take the chance of any rain that may fall during the growing period.

The kind of plough to use will depend on the soil and method of clearing. In most cases the stump-jump and disc ploughs will be most suitable, but on the sandy soils when well cleared a light two or three furrow plough of the "cock shut" type will be found very useful. Sowing with a drill is strongly recommended; and a drill possessing a fertiliser attachment will eventually be necessary. The application of a small quantity of superphosphate (say ½ cwt. or 2s. 6d. worth per acre) will probably be found very profitable after the first season, whilst the sandy soils may require potash. The Department is conducting local experiments to test these questions. Couch grass is proving a troublesome weed; and drastic methods will be necessary. Disc cultivators, although splendid for most weeds are not so effective for destroying couch grass, as they chop it into small pieces, each knot of which will grow again. Spring-tooth cultivators are better to drag out the couch. Lever-tooth harrows are also advised for collecting couch, and also for harrowing the growing wheat crops. In wheat-growing, when sown for grain alone, Federation has so far proved the most prolific and drought-resistant variety in the surrounding

districts. Bunyip is recommended as a good early wheat for this locality. Since the extension of the railway line to Walgett and Collarenebri, settlers are assured of a good market for their hay and chaff. It will, therefore, be safer to sow wheats like Bobs and Comeback that produce sweet hay or good grain, as in a dry time it will often pay better to cut the wheat crops for hay. A reaper and binder will, therefore, be a necessary implement. Where the stripper is used it will pay to run the binder back the reverse way of the harvester and save the straw. Straw-stacks occupy very little room on the place and eat nothing, but in a dry time a few hundred tons may often be converted into as many pounds. Whilst droughts are liable, and until the adjoining pastoralists practise more irrigation and conservation of fodder, the local farmer may be sure of a good market for his produce, although he may have to hold it for a few years before a chance for big prices occurs. At the present time settlers could make good money by taking in sheep on agistment on their wheat crops. Early sown crops are all the better fed off, as the trampling helps to consolidate the sandy soils. The paddocks, however, should be subdivided, and the sheep not left on one portion more than a fortnight at a time. After a few years, as the spear and corkscrew grasses become burnt off or destroyed, each settler should keep a flock of sheep to clean up weedy land and stubble, and provide lambs for fattening on the rape and other rotation crops which, there is reason to believe, can be grown successfully. Some of the heavy belah and brigalow country will probably prove too strong for wheat, and require too much horse-power to cultivate profitably. On such soils, which should be roughly broken and fallowed by the system described, lucerne should be tried. The best time to sow will be February or March. It is useless sowing lucerne on couch-infested land. The seed is expensive ; therefore, if it is not sown at the most favourable time on land well prepared, it is merely throwing money away. Of course, it must not be expected that the lucerne will grow so luxuriantly as on rich alluvial flats, for example, but there is local proof that it will greatly improve the grazing capacity of land too strong for wheat, and if shut off from stock after rain will provide one or two cuttings per year. After being fed off, it should be well disced or stirred with a spring-toothed cultivator.

The experience of the district is that maize is rather an uncertain crop for grain, as hot winds may at any time burn off the tassels, and no cob result. The dairy farmer, however, can be sure always of a good growth of corn stalks, which he can convert easily into silage. Quick maturing varieties, sown about December, have the best chance for grain, for February being the month of greatest rainfall the conditions are more favourable for cobbing. It is generally agreed that maize grows much better in a dry time if sown in the check system, 4 feet apart each way, than if broadcasted or sown close in drills. A home-made implement can easily be devised to make marks at right angles to the furrows. Two or three grains should then be sown in the bottom of the furrow at the intersections. The crop must be kept free from weeds by frequent shallow cultivation. The ordinary cultivator can generally be adjusted to cultivate two or three rows at a time by removing some of the tines.

One settler on the Baradine Road has been growing maize for grain and wheat for hay alternately, obtaining two crops per year from the same ground for some years. The variety of maize that gave best returns was Pride of the North, and the portion inspected by the writer appeared to yield about 50 bushels to the acre. This was an exceptionally sandy flat near a creek, but it furnished a good illustration of the productiveness of the soil under energetic cultivation.

Dairying has already proved a profitable industry in the neighbourhood of Pilliga Scrub. Much of the land is within convenient distance from the North-western Railway, and cream can be easily forwarded to Narrabri. This town possesses an up-to-date co-operative butter factory, which is worked on a profitable basis, and has frequently topped the market for its first-grade butter. In a district like this the successful pursuit of dairy-farming will be largely dependent upon the provision of stand-by fodder, and for this purpose the ensilage of natural as well as of cultivated growths is to be recommended. This method has been well demonstrated by Mr. John Gray, of Glencoe, Wee Waa, who converts the native growths into juicy silage at a cost of about 3s. per ton, and his example might well be followed by future settlers. The Agricultural Department will be pleased to forward all information and give practical advice on this subject. If the silage is to be used in a few months' time, the stack system is satisfactory; but for a grazier, who may not require it for two or three years, the stacks dry out too much, and the pit system is preferable.

Grasses.

The summer growth in the ringbarked country, after rain, affords an interesting collecting field to the botanist, and an abundant fodder for the selector. Nearly all of the useful and many of the detrimental indigenous grasses are to be found. The latter, consisting chiefly of corkscrew and spear grasses (*Aristida* and *Stipa sp.*) should be destroyed by burning off, mowing and feeding down, or ploughing up when possible. The useful grasses should be preserved from overstocking, and their seeds distributed. Amongst the best noted and identified by the Botanist were blue grasses (*Andropogon affinis*, *A. intermedius*, *A. pertusus*, and *A. refractus*); sugar grass (*Pollinia fulva*); star grasses (*Chloris truncata*, *C. ventricosa*, and *C. acicularis*); couch grass (*Cynodon dactylon*); white top (*Danthonia pallida* and *D. semi-annularis*); early spring grasses (*Eriochloa punctata* and *E. annulata*); love grasses (*Eragrostis Brownii* and *E. leptostachya*); plume grasses (*Diplachne Peacockii* and *D. crinata*); and panic grasses (*Panicum decompositum*, *P. effusum*, *P. leucophæum*, and *P. flavidum*). Of the exotic grasses, *Paspalum dilatatum* and Rhodes grass (*Chloris gayana*) will prove the most suitable to the sandy soil along the creeks, but it is not recommended that much money be expended on introduced grasses. If the same time and preparation be devoted to the cultivation and preservation of the best indigenous grasses more satisfactory results will be obtained. For example, a luxuriant growth of a tall blue grass (*Andropogon intermedius*) was noticed inside the railway line near Turrawan, and the seed could easily be collected.

Many of the swamps and shallow waterholes in the scrub are covered with the brown-flowered swamp grass (*Diplachne fusca*), of which the seed could be easily obtained at the proper time. In other places a cartload of black seed-heads of the star grass (*Chloris truncata*) could be raked up in a few minutes. Stock are extremely fond of this grass in its young state, and eat it in preference to all others. The weeping love grass (*Eragrostis pilosa*) is useful for sowing with the wheat, as it will often produce a green bite for the sheep in the stubble after harvesting. The annual grasses (*Anthistiria membranacea*, and *Eleusine œgyptica* and *E. indica*) are also spreading into the scrub from Queensland, and are great favourites with all kinds of stock. Settlers noticing any new or peculiar varieties of weeds or grasses are advised to send perfect flowering specimens to the Department, whence all information will be forwarded by the Botanist.

The sand ridges appear to be peculiarly adapted to the growth of fruit-trees. Splendid thin-skinned oranges and lemons can be grown, provided the young trees are bushed or protected with corn-stalks from frosts during the first few winters. Apricots, peaches, nectarines, Japanese plums, and all kinds of grape-vines grow luxuriantly, whilst the climate is ideal for sun-drying fruit. The district is rather hot for apples, but some of the early varieties can be grown, and the Bartlett and China type of pears (Le Conte, Garber's, and Kieffer's Hybrid) grow and fruit abundantly. Date-palms can also be seen growing well in the abandoned gardens at Old Wangan and other places. Settlers contemplating planting an orchard on a commercial scale are strongly advised to correspond with the Department, when the Fruit Expert will forward information as to the most profitable varieties. Passion fruit, chocos, pumpkins, melons, tomatoes, cucumbers, cabbages, and all kinds of vegetables grow well.

It has been demonstrated that bees work exceptionally well in the scrub, as the sand ridges grow many shrubs and flowering plants early in the spring. Even when much of the country has been ringbarked, there will always remain forest reserves, stock routes, and watering places, which will provide ample space for honey collection.

Poultry do well, but care should be taken against the fowl tick (*Argas americanus*) by hanging the perches on fencing-wire passed through inverted bottles containing kerosene. It is cheaper to provide proper perches than to allow the fowls and turkeys to roost on the binder or harvester. These implements are expensive, and in such climates require shed shelter more than the poultry. Cases were noted where implements had by exposure depreciated 50 per cent. of their value in two or three years, sometimes before the final instalments had been paid off.

It should be distinctly understood that whilst portions of the scrub are capable of great agricultural development, there are other portions that should be left severely alone. The latter include the bloodwood and white-gum country, the grass-tree and honeysuckle scrub, and the raw "sandy beach" portions. Land thickly infested with prickly-pear, or very uneven "monkey" or "crab-holey" land, covered with brigalow, is better left alone for the present.

The men who are most likely to be successful in Pillaga Scrub are those of moderate capital, possessing a team of horses and practical experience in bush work and farming. Owners of horse teams will be able to obtain work between the sowing and harvesting of wheat crops by drawing logs to the mills. Some of the sawmills also provide a limited local market to existing settlers for eggs, honey, pork, bacon, mutton, butter, fruit, and vegetables. Probably 1,000 acres of the better portions of the scrub will be found sufficient for a living area, and as much as a man can develop in a lifetime. Such a block, of course, will only be a living area for one family, and the children could each take up additional holdings as they came of age. Selectors who can build their own houses, sink the wells, and fence their blocks, assisted by a family who would attend to the dairy, orchard, poultry, garden, bees, &c., should eventually make a comfortable living on the areas available.

There is abundant proof, that if populated by industrious settlers, whose chief income will be derived from sheep and wheat produced under a practical system of fallowing, that the Pilliga Scrub, which has been described as "a native dog, prickly-pear, and rabbit-infested wilderness," may be developed into a fertile and prosperous mixed farming district.

Waste of Timber.

Mr. Geo. Marks, Inspector superintending demonstration areas in the Northern districts, in the course of his travels has noticed that settlers on thousands of acres of new country between Werris Creek and Tamworth are burning off practically every stick of box timber.

Mr. Marks states:—"In travelling through some of the farming districts, one cannot help noticing the large amount of timber that is being destroyed by fire. On most of the holdings where clearing is in progress, the farmer is anxious to get his crop in without delay. This is very noticeable in the Tamworth District; and in view of the fact that a large number of the Peel River Estate farms will shortly be disposed of, it may not be out of place to draw the attention of settlers to a few facts.

"In Tamworth, firewood for household use, costs from 11s. to 13s. per ton, and upwards. The flour-mills, brick-kiln, and brewery are large consumers, and the present supply has to be drawn some little distance from town. Several old farmers have defrayed the cost of clearing their farms, which in many instances amounted to £2 per acre, by selling the timber to firewood dealers. Something might be done in the direction of stacking a quantity of wood instead of burning, and there is no doubt that a business man with some capital to work on would find a safe investment in buying, and storing for future use in the town. On the other hand, many logs for which the occupier has at present no immediate use could be drawn on one side and kept for future use for building or fencing purposes. The timber on these farms, mostly box, is a valuable asset, and firewood and suitable building material is becoming scarcer each year."

Stack Silage at Tumberumba.

DURING the latter part of last year, Mr. A. J. Garner, Secretary of the Farmers and Settlers' Association at Wollesley Park, near Tumberumba, made a request to the Department of Agriculture that an officer of the Department should give a practical demonstration in making oat silage by the stack method, at Mr. Eisenhauer's farm, Wollesley Park. The desire was acceded to, and Mr. Mark Reynolds was instructed to carry out the work, which was commenced on the 23rd December.

To *Gazette* readers the necessary operations in the construction of a silage stack are well known, and a short description only is necessary. An interesting feature of the work was the hearty co-operation of neighbouring farmers in assisting Mr. Eisenhauer in the work of construction. Much of the enthusiasm was worked up by Mr. Garner. Mr. Reynolds therefore did not want for manual labour, and that of the right kind.

There were two farmers present known for their ability in haystack construction. A few words of explanation on the difference between building for ensilage and for hay, and they were quite at home at the work. Mr. Eisenhauer drove the reaper and binder, and the remaining farmers, six in number, carted, with horses and waggons, the sheaves from the field to stack. Should the farmers continue assisting one another on an occasion like this, there is no doubt success will follow the joint ownership by a number of farmers of a silage chaffing plant. On this occasion the work progressed smoothly and expeditiously. Farmers present stated their intention of growing crops next season for ensilage. The loss in making silage by the stack method was discussed with that of other methods, as in the pit and tub; but those present preferred the stack method for a start, and no doubt will adopt the pit or tub later, if only for the reason that much less waste occurs by these latter methods. Mr. Reynolds, during spells for "smoke-oh," also explained to the farmers methods of regulating temperature by weighting, and practical methods for doing so; the relative value of different forage crops when converted into silage, and also different methods of elevating the fodder.

For the purpose of ascertaining the temperature during the curing process a $\frac{3}{4}$-inch water-pipe was built in the centre of the stack, protruding on one side and having sufficient slope to enable a thermometer to slide down. Instructions were given to increase the weight should the temperature exceed 160° F.

The crop at Mr. Eisenhauer's consisted of a heavy rather coarse growth of Tartarian oats on the ripe side. It was recognised that Mr. Eisenhauer would have reaped a greater monetary benefit had he cut the oats for hay; but he was desirous of practical knowledge with ensilage, and had no other fodder crop available.

From the appearance of the crop and the acreage available it was calculated that about 70 tons of fodder would be removed with the reaper and binder. One end of an old slab-sided shed, which at one time was covered with thatch, was selected for the place of location of the stack. The drainage around the shed was then seen to. Posts were in a convenient position in the shed to act as guides to the stack builders. A space 14 feet by 18 feet being available between these posts, the stack was built with a base of these dimensions. On the earth was laid a bed of rye straw and on this the oaten sheaves stacked, the binder twine being cut to ensure greater compactness. The oats being on the dry side it was considered necessary to add water from time to time, and for this purpose an orchard spray-pump was found useful. The water added averaged about 4 gallons to the ton. Salt was also added at the rate of, approximately, 3 lb. to the ton.

The rapidity with which the farmers fed the stack made it necessary to keep up spirited treading, and the stack was heavily weighted at lunch time. At nightfall the stack was again weighted, a framework of logs of even weight being placed on top of stack and further logs placed on these. The stack was then left to settle down for forty-eight hours, to enable the temperature to be better regulated and to obviate excessive hoisting.

The final filling and weighting was left to Mr. Eisenhauer, and the method of compression suggested was to hang logs placed on either side of stack suspended by No. 6 fencing wire passed over the stack, and resting on pieces of scantling placed 3 feet apart. The spaces available on three sides of the stack inside the shed were filled up with rye straw, and the other side, that was subject to the prevailing winds, was partly exposed to the weather. The dimensions of the stack, on completion or subsequently, were not ascertained, but it was calculated that the stack would shrink sufficiently to enable the roof of the shed to be replaced two months after the building operations were completed. A temporary covering was available until that time. Information has been received from Wollesley Park, that on cutting out the stack this month, the silage was well cured and satisfactory.

The stack was subsequently inspected by Mr. Inspector Ross, who reported as follows :—"The stack was of small proportions, well built, and the pressure, effected by placing posts and heavy pieces of timber on top of the stack, appeared to have been distributed evenly. On opening the stack it at once became apparent that (as indicated by Mr. Inspector Reynolds) the crop had been allowed to become too ripe; the straw had become hard and the grain had formed. Although the silage was of fair colour, it lacked that soft consistency and juicy appearance which is obtained only by cutting the crop green and while the grain is in the milky stage.

"However, the milch cows and heifers relished it greatly.

"Mr. Eisenhauer agrees with me that it is especially to the farmer or dairyman in a small way that the value of ensilage ought to appeal, as it offers a means by which the carrying capacity of small holdings, such as his, can be considerably increased, and animals turned to profit that otherwise could hardly be kept on the farm at all."

Ekpwe Maize.

As the Ekpwe maize of Southern Nigeria was mentioned in the report of the Liverpool University Institute of Commercial Research in the Tropics as being one of the best of white varieties of maize, and considered to be of high value in the London market, steps were taken to procure a sample of the seed for trial in this State. Unfortunately the seed did not reach Sydney until December, 1907, which was rather late for a definite trial, but it was forwarded in trial lots to the Hawkesbury Agricultural College and to the Experiment Farms at Wollongbar, Grafton, Berry, Bathurst, and Glen Innes, for test in comparison with approved local varieties.

At Bathurst the seed was sown on 17th December, and the plants had attained a height of 9 feet and were just in tassel when, on 21st March, 1908, they were cut down with frost and consequently no seed was formed.

At Berry the grain was found to be damaged by weevil, and only three seeds germinated.

The same difficulty arose at Glen Innes, but Mr. Gennys managed to find a few sound grains, and they produced a fair stalk which cobbed well, but the grain did not mature. From what he observed, the Manager of Glen Innes Farm came to the conclusion that if the maize had been sown in October a fair crop of grain would have matured.

At Wollongbar the Ekpwe maize was a complete failure. The stalks grew to a height of 3 feet, but the whole yield from a row 40 yards long would scarcely fill a teacup.

Mr. A. H. Haywood, Manager of the Experiment Farm, Grafton, sowed his sample on 16th December, 1907, on red soil, in rows 4 feet apart and 15 inches in the row.

The plants produced a very coarse stalk, and on some of the stalks there were as many as four cobs, which, however, did not mature properly. The tassel of this maize, which appeared on 29th February, 1908, is different to that of any other variety Mr. Haywood is aware of, being of a very heavy nature. The stalks attained a height of 9 feet.

Bandicoots destroyed about 20 per cent. of the crop, and the resulting yield was 24 lb. from about ½ lb. of seed. So far as he could judge by that one trial, Mr. Haywood did not think the Ekpwe maize was one that gave much promise because it appeared to be a long way behind the variety called Tuscarora introduced some years ago, and which did not excel several of the local kinds. However, it was necessary to see how the maize would shape when acclimatised.

As the result of a second trial under favourable conditions, in 1908, the Manager of Glen Innes Experiment Farm reported that this variety is absolutely unsuitable for New England District.

At Berry the seed germinated badly and the crop failed, so that it may be regarded as a failure in that district also.

The abnormal dryness of the spring prevented the Manager of Wollongbar from obtaining any conclusive result.

On the Clarence, at the Grafton Farm, the variety proved, on its second trial, a failure as a grain producer.

A second trial of the maize was made at Bathurst on 11th November, 1908. The plants grew to 9 feet 6 inches in height, and produced two immature cobs to each stalk, but no grain was formed. Mr. Peacock states the season this year was too short for this variety; many of the summer crops failed to mature seeds for the same reason.

In the first trial of this maize at the Hawkesbury Agricultural College Farm, on 20th December, 1907, Mr. McDonald found the samples to be badly infested with weevil, and he therefore put in the seed thickly in a short row. Only a dozen plants grew, and these made very little progress until the end of January owing to dry conditions. Heavy rains fell in February, and the maize grew quickly and was ready to harvest on 20th May.

From the number of plants available it was not possible to estimate the yield per acre, but the cobs were of medium size with flinty white plump grain of small size. The core is white and very large in proportion to the quantity of grain.

Concerning last season's trial, Mr. McDonald reports:—"The Ekpwe maize in our experiments this year has not proved successful as a grain yielder. Its behaviour was somewhat remarkable and indicates that it has not yet become acclimatised. Last season it was rather short in height and matured very early, but this season it was late. The stalks were very tall, and were higher than those of any other variety we had growing at the time, but were sparsely covered with flag or leaves. Very few cobs were produced, about 50 per cent of the stalks being quite barren. The cobs were small and imperfectly filled. They were enclosed in very long, coarse husks, which were difficult to remove.

"The season was not altogether favourable to grain production, and the yields were low, but the returns from a well-known local variety, Red Hogan, grown under the same conditions as Ekpwe, enable a fair comparison to be made.

"The yields were:—

Red Hogan...	27 bushels per acre.
Ekpwe	$7\frac{1}{2}$ " "

"Both varieties were sown on 7th September, 1908, on good alluvial soil, without manure, in drills 4 feet 4 inches apart. The soil was thoroughly cultivated and kept free from weeds during their growth. Red Hogan, one of our latest varieties, was mature on 5th April, 1909, but Ekpwe was not fit to pull until the end of April.

"The rainfall during the time the crop was on the ground was:—

September ...	·57 inches.	February ...	6·45 inches.
October ...	·37 "	March... ...	·38 "
November ...	2·13 "	April	·36 "
December ...	1·12 "		
January ...	1·27 "	Total ...	12·65 inches."

After only two seasons' trial it is impossible to finally condemn a new variety, but it certainly does appear that this Southern Nigerian maize is not likely to be worthy of a place in our list of profitable varieties.

Seasonable Notes.

Hawkesbury District.

H. W. POTTS.

The welcome fall of rain last month aroused all the activities available on the farms in this district.

Many farmers continue to follow the practice of awaiting winter rains before sowing; others, with a keener regard for earliness and less fearful of losing the seed through continued dry weather, and who had sown, now reap the benefit, seeing germination followed the rain quickly, and the crops are well forward.

Farming operations have been unusually delayed this season in consequence of the persistent absence of moisture. Sufficient rain has fallen now to assure a hay crop and a fairly good spring, and the prospects are more reassuring and cheery than those forecasted last month. Frosts so far have been mild and the early crops have not been affected by them.

The work of the month will be heavy on many farms in order to complete the sowing of the main cereal crops.

The work of stall-feeding stock has to be taken in hand to supplement the sparse pasturage left at the end of a dry summer. Where the opportunity was seized last February to grow late crops of maize and sorghum for ensilage the benefit will be readily realised now. Stack, tub, and pit silos are being opened to provide bulk fodder.

Oats.

The sowing of the main crop of oats can be completed this month.

Rye.

Again it is necessary to refer to the value of this plant as a supplementary crop for green fodder, straw, and grain.

In this district, especially on the poorer soils of the uplands, Emerald Rye will fully repay the cost of cropping and afford a class of food which is wanted when the pastures are dry.

Rape.

This plant is becoming better known, especially for feeding sheep and pigs. The plant, in addition to being appetising and attractive to stock, has a high feeding value, placing it in close relationship with clover. The chemical composition points to it being a flesh-former of great value It is especially serviceable in fattening old ewes and it serves to bring young ewes into suitable condition for breeding. Lambs always thrive on it, and more so when it is judiciously blended with carbonaceous foods such as mixed pasture, hay, chaff, maize cobs, or barley.

For pigs we find that brood sows keep in good condition with rape when given a few maize cobs in addition. It is one of the cheapest crops for young growing pigs. Calves take to rape at an early age, and in topping steers for market it is invaluable.

The great advantage of the crop to the mixed farmer is its place in the rotation. It does not occupy the ground longer than nine or ten weeks and hence it forms a catch crop of considerable assistance in preparing ground for maize or sorghum. When grazed, the crop not only leaves valuable organic matter from its roots but also manure from the stock turned on to the crop. Where the early crops sown in April and May are eaten off already, a second growth may be secured by resting the paddock. Further crops should be sown now to feed off in September and October, and to prepare the land for late summer cropping with maize or sorghum for next winter's fodder.

Maize.

The final operations in the maize harvest can be completed at once. The crop pulled in the early part of the season is sufficiently dry for husking and shelling.

Where husking is carried out in the paddock and the cob is large and thick, see that the cob is fully mature. The feed value of the stalk at this period of the year with the usual scarcity of fodder is of much importance, and in the total food nutrients of a ripened cob and stalk it has been estimated that 37 per cent., or about one-third, available nourishment suitable for stock is found in the stalk, and 63 per cent., or two-thirds, in the ear or cob. It has been shown that where maize stalks are fed alone, or shredded and converted into stover, animals maintain a normal condition during the winter months. More of this dry and somewhat unpalatable looking stuff is needed by the stock than hay or chaff. The food value of two parts of maize stalks will equal one part of chaff or good hay.

Maize stalks form a digestible roughage and combine well with other foods, such as silage, lucerne, clover, or concentrated foods, to form a balanced ration. Numbers of dairy farmers take advantage of this and the stalks are not only passed into the sheds or yards whole but they are being chaffed with lucerne and hay. In most instances the cattle are turned into the paddock where the stalks are growing and they select the most edible portion, eat it, and trample the balance down. Maize stalks in this condition possess a manurial value ; moreover, they are associated with manure from the stock.

Where it is not possible to feed off the stalks they can be cut or rolled down and ploughed in. All this provides enriching organic matter for the soil. It increases humus, provides nourishment for desirable bacteria, develops useful soil fermentation, improves the mechanical and physical properties of soil, and increases its moisture-retaining capabilities.

Maize stems decompose quickly and whilst troublesome to plough in at first, the reward fully compensates this.

Preparation of Land for Summer Crops.

The most urgent of the outdoor operations this month is the preparation of land for summer crops, and in this district the staple one is maize. To obtain a maximum growth of stalk and a prolific ear needs an enriched soil in good mechanical condition and of fair depth. Should this not be available, it is possible to bring large areas under profitable conditions by cultivation, the growth and ploughing under of leguminous crops, and the application of manures.

Our old maize lands along the Hawkesbury Bottoms need restoration in many places owing to the persistent cropping of corn without fertilisers, or any system of rotation.

Our chief concern at this stage is to cultivate deeply and subsoil in order to render the soil loose and enable it to absorb and retain as much moisture as possible. To assist the retention of moisture, organic matter of any kind turned in will answer. Green catch crops, leguminous if possible, green growths of any kind, stable manure, or weeds that have not gone to seed, will assist in this object.

A supply of humus and a moist, loosened, deep subsoil provide conditions suitable for maize growing.

Land must also be got ready for sorghums, millets, lucerne, pumpkins, and potatoes.

The usual winter odd jobs about the farm will require attention, such as the repair of fences and gates, and also to roads, drains, ditches, and water-courses.

Riverina District.

G. M. McKEOWN, Manager, Wagga Experiment Farm.

As the weather is too cold for sowing most seeds, the work of the month will consist of ploughing and preparation of land to receive all possible moisture for the following crops, which should be sown in the months set opposite each, viz. :—

Lucerne.—August to middle of September.

Sheep's Burnet.— „ „

Sorghum.—Middle September to end of October.

Maize.— „ „

Pumpkins, Melons, and Cucumbers.—Middle September to end of October.

Millets.—September and October.

Vegetables.—All growing crops, such as cabbage, cauliflowers, peas, beans, carrots, and parsnips, should be well tilled by means of horse or hand hoe.

Lucerne may be sown in two seasons, viz., autumn and spring. In the former, March and April are the best months, and in the latter August and September are generally the best, although when the winter is a mild one,

sowing can be undertaken as early as the latter half of July. As the autumn-sown crop is usually more liable to suffer in competition with weeds which start with it, the spring is the most favoured sowing time inland.

Naturally the best situations for lucerne growing without irrigation are low-lying lands with a good depth of soil, and a possibility of the existence of water-bearing drifts at a fair depth.

As such conditions are not available on the majority of farms, the sites nearest approaching those described should be selected, as it will pay to have an area, however small it may be, under lucerne.

The land should be subsoiled if the subsoil is not free enough to be easily penetrable by roots; but if it be of a free nature it may be ploughed as deeply as the soil will permit without bringing sour soil to the surface.

A fine, firm seed-bed should be prepared, as it is inadvisable to cover the seed very deeply, about an inch being the maximum.

The best seed is that grown in the Hunter or Tamworth districts. Care should be taken to ascertain whether the seed is free from weeds and dodder.

If sown through the grass-box of a wheat drill 4 lb. per acre of seed of the best quality will be sufficient, as the ground will be in the course of a few months fairly covered. If sown broadcast, 10 lb. per acre will be required under ordinary conditions, but in irrigated land it will be found desirable to sow not less than 15 lb. of seed per acre, as the increased quantity will check a tendency to produce too woody a growth.

Seed sown broadcast may be covered by lightly harrowing, or by rolling, according to the condition of the soil. If it be desired to use fertiliser with broadcast seed it should first be sown underground by means of the drill, as surface-sown manures in dry localities are comparatively ineffectual, and in some cases they are injurious, as they attract the roots of the crop to the surface stratum.

The use of fertilisers is recommended in wheat land of the ordinary quality, as even a small quantity deposited with the seed is of great assistance to the young crop in its competition with weeds.

About 50 lb. of superphosphate drilled with the seed will be found to give very satisfactory results. The application of potash has, so far, proved unprofitable, but at some time in the future its application may become necessary.

North-western Plains.

A. E. DARVALL, Manager, Moree Experiment Farm.

This month and August should be devoted to ploughing the land that is to be sown in the spring; the earlier the land is ploughed the better condition it will be in. Leave it in as rough a condition as possible in order that the frost and the rain may get into it as far as possible, and by September you will find that it will harrow down well and be ready for the sowing of lucerne, maize, pumpkins, and other spring crops; also grasses of any kind that are to be sown or planted.

Orchard Notes.

W. J. ALLEN.

July.

Pruning.

It can hardly be expected that our apple trees, which this year carried such heavy crops of fruit, will produce anything like the same crops next year, as such a crop tends to weaken the trees even under the most favoured conditions, while those which have been partially neglected this season will in all probability take a rest for a time. It is even possible they may bloom well, but it is more than likely the fruit will not set. The pruning of such trees will not be a very hard task this year in many instances as in all probability they did not make any heavy growth. If there are any misplaced limbs or crowded branches, they may be cut off or thinned out. The tree should be thinned out, but not cut back too severely this season. Trees which have not borne need not have much wood taken out of them, provided they are now old enough to begin carrying crops. We find in some cases that by continued hard cutting back every winter there is a tendency to produce wood in place of fruit. It is well, therefore, to allow some varieties to go for a year or two with little, if any, cutting back or thinning, though the ordinary summer pruning should not be neglected.

These remarks apply more particularly to apple and pear trees than to stone fruits.

There is usually an abundance of fruiting wood on any of our best plums, peaches, apricots, nectarines, &c., and the pruning of same, after they have commenced to bear, is more a question of thinning and shortening the past season's growth. We find our growers encouraging good fruiting spurs through the centre of the trees as they are beginning to realise that it is there that some of the best fruit is grown. At one time it was customary to keep these main arms quite bare of spurs, but such are being encouraged now in place of being discouraged.

Planting and refilling orchards.

Good seasonable rains have fallen in many parts of the State during the last month, and in consequence the soil has been in splendid condition for planting new orchards, and refilling in those already established. If such planting has not been completed, see that it is finished this month, as the sooner now that young deciduous trees and vines are planted the better.

Varieties of Apples to plant for Export.

Up to the present we have only proved a few of the many varieties of apples we are growing to be suitable for export, the two best being Cleopatra and Jonathan. Munroe's Favourite, Five Crown, and Granny Smith are also very good. The Buncombe is an apple which is doing well in our cooler climates, but is rather lacking in flavour, and does not colour quite early enough for the English market. The Rome Beauty is also a good keeper, and a good flavoured variety, but it too ripens somewhat too late for the Continental market, though it would suit the American market. Esopus Spitzenberg does remarkably well in many of our apple-growing districts, but up to the present we have not tested its carrying quality. Pomme de Neige is a beautiful medium-sized dessert apple for the local market. It is very difficult to beat the Cleopatra, which is a consistent cropper, does not take Bitter Pit badly in this State, carries well, ripens early, and sells well in the Old Country. It brought about a shilling less than Jonathan this year, but the trees usually carry about twice as much fruit.

San José Scale.

The following wash has been found one of the best, viz.:—15 lb. of best lime, and an equal weight of sulphur, to 50 gallons of water. The sulphur, after being mixed with enough water to form a thin paste, is put into 12 gallons of water nearly at the boiling point, the lime is then added, and the mixture boiled for forty minutes with the necessary stirring. The whole is strained into a 50-gallon tank which is then filled with water. This latter is claimed by the Agricultural Experiment Station, Illinois, U.S.A., to be the most effective out of eleven sprays tested in the destruction of San José Scale. It is important that the operator should bear in mind that solutions made by stirring the sulphur into the hot water first, and adding the lime to this mixture, are more efficient than if the order of procedure is reversed.

Citrus Crop.

The past season has been a very unfavourable one, yet there can be seen in some of our young citrus orchards fair crops of oranges; the older trees, however, in many places have very light crops.

Bandages for Codlin Moth.

These may now be removed from all apple, pear, and quince trees, and all grubs found thereunder destroyed. Such bandages may then be boiled and, if in good condition, put away for future use. In no case should bandages be allowed to remain on trees all winter, nor should they be removed without destroying all grubs thereunder at time of removal.

A good Early Peach.

The Sneed Peach is the earliest peach we have at the Hawkesbury Agricultural College orchard, and is a good variety for planting on light soil.

Apples at Bombala.

Some years ago, when visiting the Bombala district, I was struck with the suitability of the soil and conditions for apple-growing. Mr. R. W. Dawson was at the time planting out a small orchard, which, as shown in the photograph, has fully realised expectations.

Spraying for Codlin Moth.

At the Bathurst Experiment orchard during the past two years experiments have been conducted to determine the most effective spray for the destruction of codlin moth.

These experiments confirmed the experience of former seasons as to the absolute necessity of spraying at least four times, *i.e.*, just as the petals begin to fall, and at intervals of a week or ten days after all the petals have fallen.

It can readily be understood that in these four applications the harm done to the embryo fruit, foliage, and tender wood of the tree by any imperfectly prepared spraying material that acts corrosively will more than outbalance any devastating effects upon the pest, and, therefore, special attention has been paid to ascertaining which preparation available can be recommended, not only as an effective check on the pest, but also which can be used without risk of injury to the tree. In these two respects the experiments at Bathurst Experiment orchard have shown Swift's arsenate of lead to be superior to arsenite of soda and Paris green.

The prepared arsenate of lead has proved very effective in Victoria also, where the use of this spray has increased very much during the past two seasons. In New Zealand, investigations conducted with the object of ascertaining whether there was likely to be any danger to human beings eating fruit from trees sprayed with arsenical preparations, showed that the risk is practically nil.

Raisin and Currant Prospects.

In tabulating the statistics of the World's trade in dried fruits, Mr. Geo. Robertson, Statistician, of Fresno, California, states:—

"Nearly eight years ago, in June, 1901, and again in 1904, and subsequent occasions, I urged the necessity to advertise and take steps to stimulate the consumption of raisins, pointing out that over-production and low prices would follow in the course of time if active steps were not taken.

"The Californian Chamber of Commerce has now taken the lead in a general effort to make raisins more popular and bring them to the notice of the public. It is an admitted fact that the home market invariably pays better than foreign markets, and the population of this country (the United States) is now large enough to consume all the raisins and the bulk of the fruit we produce.

Raisin Crop of the World.

Country.	lb.
Spain (raisins)	52,896,000
Smyrna (sultanas)...	116,480,000
Greece (sultanas)	6,720,000
Commonwealth of Australia—	
Victoria (raisins)	10,990,224
" (sultanas)	3,167,360
South Australia (raisins)	1,805,776
New South Wales (raisins)	100,912
South Africa—	
Cape Colony	2,000,000
California (raisins)...	100,000,000
	294,160,272

Currants.

Greece	369,600,000
South Australia	2,607,472
Victoria	1,313,760
	373,521,232

"The acreage in vines of all kinds is increasing in all parts of Australia, and in a few more years Australian growers will probably be able to produce more than enough for their home consumption, both of raisins and wine. If any growers imagine that good raisins, currants, and dried fruits cannot be produced in Australia, they should inspect the samples lately received by the Californian Chamber of Commerce.

"The above countries are practically the only ones which produce raisins and currants. Some raisins are grown in Chile, and also in Persia, but they are consumed locally. There is little or no demand for Californian raisins in Australia at the present time, both on account of local production and also because the import duty on them amounts to 3d. per lb. New Zealand

takes about 1,000,000 lb.; but the best customer is Canada, which consumed in 1907 upwards of 6,000,000 lb., and no doubt a larger market might be found there if steps were taken to bring them more before the public.

"It has recently been suggested that a large quantity might be disposed of to the many co-operative societies in Great Britain, but it has been proved long ago that they cannot compete with the Spanish raisins, owing to the low cost of production in that country."

British Fruit Markets.

Although the exportation of fruit from this State to Great Britain is a very minor and spasmodic industry, a good many growers with an eye to future developments are keenly interested in the doings of British markets. Arrangements have, therefore, been made to obtain through the Agent-General regularly returns concerning the operations of the leading fruit markets, and as often as possible reports from leading brokers who are interested in the development of our export trade.

It is customary for big firms of brokers and auctioneers at the Monument and Covent Garden in London and at the Liverpool, Bristol, Glasgow, and other important markets to publish for distribution among the buyers and vendors a printed catalogue and price list. These would be too bulky for reproduction in each issue of the *Gazette*, but they will be kept on file in the Department, and available for reference by anyone interested. Fairly large consignments of summer fruits now reach London from South Africa, and have a regular place in the market. It is not clear at present whether New South Wales growers could hope to land their peaches or apricots in equally good condition, but the treatment of the South African consignments of apricots, for instance, serves to show the importance of get-up. This year some South African packers forwarded their apricots in small boxes, each containing sixteen to twenty fruits, and twenty boxes packed in a crate. These fetched readily from 2s. 9d. to 3s. 3d. per box, the higher price being paid for the larger fruit. In fact in the case of apricots and nectarines, large size is such a rarity that big fruit always attracts special notice. Apricots packed in boxes containing twenty-four to thirty-two fruits sold at 7s. to 8s., and boxes containing thirty-six to forty-eight fruits, 7s. to 7s. 6d. Valencia oranges, packed 420 in a case, were sold at 8s. to 15s., while those of the same variety going 714 to the case, were sold at from 10s. to 14s.

From advices just to hand, it appears that 400 cases of apples from Bathurst Orchard sold in London at from 10s. 6d. to 11s. 6d. per case, or an average of 1s. per case higher than any other apples, out of 80,000 cases on the market. Good packing was entirely responsible for this result.

Soil and Water Problems at Tomerong.

Mr. J. Hawken, who occupies 400 acres of land in the Tomerong district, reports that since he took up his area of 400 acres in 1890, a number of people in the locality have failed to get satisfactory results and have left their holdings. The tract comprises tens of thousands of acres of sandstone formation, slightly undulating, and naturally well drained. The soil is sandy to a clay, which becomes loamy when worked.

Mr. Hawken states that he has succeeded in establishing a good orchard of 1,200 trees, mostly apples, on his holding, "by breaking the soil to the depth of 18 inches and mixing it again and again." He has had good crops of apples for fifteen years without adding manure.

At the invitation of the Department Mr. Hawken submitted three samples of his soils for analysis—No. 1 from an area in its natural state; No. 2 from an area that has been cleared ten years of native timber, but not cultivated; and No. 3 from under the apple trees of fifteen years' standing. This last soil has been ploughed and worked twice each year.

Mr. Hawken submitted also two samples of water—one from the uncleared area and one from the cultivated portion of the farm. He said that cattle grazed exclusively on the virgin land, and drinking the water collected there, did not mature, the bone development being defective.

The Chemist, Mr. F. B. Guthrie, reports:—

The soils are all very similar. The orchard soil is more clayey in nature than the others, but they are all very sour, poor soils, and low in organic matter. Want of lime and nourishment in the grasses is probably the cause of the bone trouble in the cattle.

Lime should be applied to the land at the rate of about 1 ton freshly slacked lime to the acre. If that is impracticable, the cattle should be provided with a lick containing phosphate of lime. A lick made of bone-ash mixed with molasses with a little salt added should benefit the cattle.

The soils are deficient in vegetable matter and this can be best supplied in the case of the orchard by growing a green crop, such as cowpeas, between the rows and ploughing it under.

For the apple orchard, apply manures as under:—

	cwt.	Cost. £ s. d.	
Bone-dust	5	1 10 0	Apply at rate of 4 lb. per tree.
Superphosphate	$2\frac{1}{2}$	0 12 6	
Sulphate of Potash	$2\frac{1}{2}$	1 17 0	
	10 cwt.	£3 19 6	

It is certainly well worth the while of orchardists, on soils similar to Mr. Hawken's, to pay attention to their trees, as the fruit that can be produced is of extremely high quality.

Mr. Hawken's fruit has taken first prize at Nowra on several occasions, and at the last Milton Show he secured first prize for the best collection of fruit.

Treatment of the Interior of a Concrete Silo.

An inquiry was made at the Department recently as to what treatment the interior of a reinforced cement concrete silo should receive to prevent the acids penetrating the walls and affecting the structure. Our correspondent had been advised to give the inside of the silo a coat of tar.

It is said that by means of a solution of silicate of soda, used just in the same manner as whitewash, a lasting impervious glaze can be formed which would serve to protect the concrete and render the silo quite air-tight.

In a special bulletin on the construction and treatment of silos, published by the Wisconsin Experiment Station, U.S.A., two coats of cement whitewash are recommended to neutralise the acids and to prevent them softening the cement.

Another Wisconsin authority mentions that last spring he finished feeding silage that had remained five years in a lath and cement silo. The fodder was in excellent condition, and the silo suffered no harm.

In the United States, brick, stone, and concrete silos are fairly common, and the general plan adopted is to plaster the inside to the thickness of nearly half an inch with cement one part, sand two (2) parts, to make a hard smooth surface, which is whitewashed with cement every second year.

Maize and Weevils.

It is generally recognised that Tumut maize will remain free from infestation with weevil while River maize in the same store may become fairly riddled with the pest. There is available a considerable amount of general data as to this fact, but so far the reason of the immunity of maize grown at Tumut does not appear to have been the subject of systematic investigation, and the Under Secretary has therefore arranged that the work be undertaken as soon as possible. Mr. Anderson points out that as Tumut is only 900 feet above sea level, and is not very cool during the growing period, there does not appear to be any definite reason why maize grown in districts of similar altitude should not also present the same features. For the purpose of careful examination for the presence of weevil or their eggs, it is desirable to obtain from as many districts as possible with an altitude, say, of 900 feet above sea-level, samples of maize as soon as they become available.

It might be added that, at the Franco-British Exhibition, the columns of the great Cereal Arch in the New South Wales Court were formed of glazed receptacles, filled with maize from Tumut and Inverell districts, which had been in continuous use since 1905 at all the leading exhibitions in the United Kingdom. It had been carried from place to place in unbleached calico bags, but when on display, the bags were opened and the contents exposed to inroads of weevils which continually destroyed all the other samples of maize received during 1905, 1906, 1907, and 1908. Tumut maize, which was awarded the Grand Prix for Maize at the Franco-British Exhibition, and which was described by the Jurors as the finest maize they had ever seen, arrived at Shepherd's Bush in a consignment in which all samples of maize from other districts swarmed with weevil.

Sheep's Burnet.

Mr. S. Peacock, of Denton Vale, asks whether it would be advisable to sow sheep's burnet with wheat as a cover crop, in the same way as they do in his district with lucerne.

Mr. Peacock says, "I desire to grow something else besides lucerne for my sheep. I have a paddock of rape nearly ready to eat off. Stock at times appear to sicken of lucerne. Nature provides a variety of grasses, and the animals do not like to be confined to one sort of feed."

In reply, Mr. George Valder, Chief Inspector, says: "Sheep's burnet is sometimes sown with wheat and other cereals in the same way as lucerne. In most districts, however, better results are obtained by sowing it alone. The difficulty is that when the wheat is cut, hot dry weather may follow, and the burnet plants, which up till then have been sheltered, are exposed to the full heat of the summer sun, and, therefore, if short of moisture, many of them are likely to die off. On the other hand, should the weather be favourable, a good stand may be obtained.

"Mr. Peacock is quite right about feeding one food to stock; it is rarely that good results follow, and in all cases the farmer should aim at providing a mixture. If cereals or grasses are fed with lucerne, stock will thrive very much better than on lucerne alone."

Native Bees which may fertilise Red Clover.

On several occasions importations of humble bees have been made from New Zealand with the object of establishing these useful insects in districts where it is desired to grow and propagate red clover.

It may not be generally known that there is to be found in several parts of New South Wales a native bee (*Sarapoda bombiformis*) very similar to the humble bee in appearance and size.

The Under Secretary observed a large number of these bees in the Illawarra district visiting flowers, and captured one for purposes of identification.

Like the true humble bees these insects belong to the apidæ (long-tongued bees), and although no actual observations have been made of their feeding habits, the Entomologist is of opinion that in obtaining the nectar from flowers these native bees perform the same functions as humble bees. They make nests in the ground also in the same manner as humble bees.

As efforts to successfully establish the humble bee in parts of this State where red clover would be a valuable crop have proved abortive, the Under Secretary will be glad if observers will notify the Department if they find this native bee in the vicinity of clover crops.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1909.

Society.	Secretary.	Date.
N.S.W. Sheepbreeders' Association	A. H. Prince	June 30, July 1, 2, 3
Pastoral and Agricultural Society of Deniliquin	L. Harrison	July 15, 16
Hay P. and A. Association	G. S. Camden	,, 20, 21
Riverina P. and A. Society, Jerilderie	W. Elliott	,, 27, 28
Balranald P. and A. Society	A. Malcolm	,, 28
Peak Hill P., A., and H. Association	J. A. McIntyre	,, 28, 29
Lachlan P. and A. Association	T. Cadell	,, 30
Narrandera P. and A. Association	W. T. Lynch	Aug. 4, 5
National A. and I. Association of Queensland	C. A. Arvier	,, 7 to 21
Royal Agricultural Society (Sydney), Horse Parade and Dairy Cattle Show.	H. M. Somer	,, 8, 9
Urana P. and A. Society	J. Wise	,, 10, 11
Corowa P., A., and H. Association	J. D. Fraser	,, 17, 18
Forbes P., A., and H. Association	H. J. Brooke	,, 18, 19
Gunnedah P., A., and H. Association	M. C. Tweedie	,, 24, 25, 26
Murrumbidgee P. and A. Association, Wagga Wagga	A. F. D. White	,, 24, 25, 26
Parkes P., A., and H. Association	G. W. Seaborn	,, 25, 26
Northern A. Association, Singleton	F. A. Bennett	,, 25, 26, 27
Grenfell P., A., and H. Association	Geo. Cousins	,, 31, Sept. 1
Barmedman Ploughing Carnival and Horse Parade Society.	P. H. Sheahan	Sept. 1
Junee P., A., and H. Association	T. C. Humphrys	,, 1, 2
Lockhart A. and P. Society	H. Parnaby	,, 7, 8
Young P. and A. Association	G. S. Whiteman	,, 7, 8, 9
Cudal A. and P. Society	P. Gavin	,, 8
Ariah Park A., H., and I. Association	A. T. White	,, 8
Germanton P. and A. Society	James S. Stewart	,, 8, 9
Cootamundra A., P., H., and I. Association	W. E. Williams	,, 14, 15
Cowra P., A., and H. Association	J. T. Martin	,, 14, 15
Albury and Border P., A., and H. Society	W. I. Johnson	,, 14, 15, 16
Canowindra P., A., and H. Association	J. J. Finn	,, 21, 22
Burrowa P., A., and H. Association	W. Burns	,, 22, 23
Temora P., A., H., and I. Association	John Clark	,, 21, 22, 23
Henty P. and A. Society	P. H. Paech	,, 28, 29
Wyalong District P., A., H., and I. Association	Thos. A. Smith	,, 28, 29
Millthorpe A. and P. Association	C. H. Shepherd	,, 28, 29
Ganmain A. and P. Association	A. R. Bolton	,, 29
Lismore A. and I. Society	T. M. Hewitt	Nov. 17, 18, 19
Tweed and Brunswick A. Society	F. A. Wildash	,, 24, 25
Berry Agricultural Association	C. W. Osborne	Dec. 8, 9, 10

1910.

Society.	Secretary.	Date.
Albion Park A. and H. Society	Hector G. Fraser	Jan. 19, 20
Kiama A. Association	R. Somerville ...	,, 26, 27
Wollongong A., H., and I Association	F. W. Phillpotts	Feb. 3, 4, 5
Shoalhaven A. and H. Association, Nowra	Henry C. Raneb...	,, 9, 10
Guyra P., A., and H. Association	P. N. Stevenson ...	,, 22, 23
Tumut A. and P. Society	E. H. Vyner ...	,, 23, 24
Gunning P., A., and I. Society...	W. T. Plumb ...	,, 24, 25
Wyong Agricultural Association	Edgar J. Johns ...	,, 25, 26
Tenterfield Intercolonial P., A., and M. Society ...	F. W. Hoskins ...	Mar. 1 to 5
Yass P. and A. Association	Will Thompson ...	,, 2, 3
Central New England P. and A. Association (Glen Innes), National Show.	Geo. A. Priest ...	,, 8 to 11
Tumbarumba and Upper Murray P. and A. Society	E. W. Figures ...	,, 9, 10
Quirindi District P., A., and H. Association... ...	W. Hungerford ...	,, 9, 10
Newcastle A., H., and I. Association	C. W. Donnelly ...	,, 10, 11, 12
Blayney A. and P. Association	E. J. Dann ...	,, 15, 16
Inverell P. and A. Association	J. McIlveen ...	,, 15, 16, 17
Upper Hunter P. and A. Association (Muswellbrook)	J. M. Campbell ...	,, 16, 17, 18
Camden A., H., and I. Society...	C. A. Thompson...	,, 16, 17, 18
Goulburn A., P., and H. Society	J. J. Roberts ...	,, 17, 18
Royal Agricultural Society, Royal Agricultural Show	H. M. Somer ...	,, 22 to 30
Gundagai P. and A. Society	A. Elworthy ...	,, 23, 24
Durham A. and H. Association...	Chas. E. Grant ...	April 27, 28

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"The Agricultural Gazette."

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Agricultural Gazette of New South Wales.

Trials of American Sorghums.

LAST year the Department of Agriculture obtained in exchange from the Bureau of Plant Industry of the United States Department of Agriculture, Washington, seed of thirteen of the reputed best varieties of Sorghum grown in Texas, one of the leading States for this class of plant.

Samples of the seed were sent for trial to the Hawkesbury Agricultural College, Wollongbar Experiment Farm, and Grafton Experiment Farm; and the reports of the first series of trials are given hereunder.

REPORT OF THE EXPERIMENTALIST, HAWKESBURY AGRICULTURAL COLLEGE.

The thirteen varieties were planted on 23rd October, 1908, in drills 3 feet apart.

The soil was a fairly fertile red loam, and was brought into good condition by thorough cultivation.

Good rain had fallen in August, and the soil was still sufficiently moist at planting to ensure even germination.

No manure was applied to the crop.

During the two months preceding sowing the following rainfall was recorded:—

August	4·75 inches.
September	·57 „
Total	5 32 „

During the growth of the crop the rainfall was:—

October	·37 inches.
November	2·13 „
December	1·12 „
January	1·27 „
February	6·45 „
March	·38 „
Total	11·72 „

The varieties reached a sufficiently mature state for harvesting at different times, and consequently the character of the season influenced the yields to some extent. The rains in February proved beneficial to the later maturing varieties, and gave them some advantage over those which were earlier. The quantity of seed available for sowing was limited, and consequently the area occupied by each variety was small. In the estimation of the yields a row of each variety, 28 feet 5 inches in length, was harvested, when it was considered to be in the best condition for use as greenstuff.

A small area of each variety was left for seed, but the greater portion was lost through the depredations of sparrows. A small amount of seed of each variety was secured, however, by covering the heads with light muslin bags.

YIELDS of the different varieties arranged in order of yield.

Variety No.	Row.	Name of Variety.*	Yield per acre. tons	cwt.	Date cut.
...	18	Andropogon sorghum (Lincoln)	23	19	17 March.
12	16	And. sorghum (Johnson)	22	11	17 ,,
...	20	And. sorghum (Grant)	19	7	17 ,,
1	9	Black Line Kaffir	17	10	17 ,,
...	15	Pink Kaffir	17	1	17 ,,
..	19	And. sorghum (Hayes)	17	1	17 ,,
9	12	And. sorghum (Garfield)	16	2	17 ,,
...	4	Planters' Friend (local)	16	2	17 ,,
...	21	And. sorghum (Jefferson)	16	2	25 Feb.
10	14	And. sorghum (Harrison)	15	8	17 March.
3	10	And. sorghum (Jackson)	15	4	17 ,,
...	7	Sorghum saccharatum (local)	14	10	25 Feb.
10	13	Pink Kaffir	14	5	17 March.
...	3	Early Amber Cane (local)	13	7	25 Feb.
7	11	White Kaffir	9	13	25 ,,
...	5	Kaffir Corn (local)	8	10	25 ,,
15	17	And. sorghum (Monroe)	8	10	25 ,,

Lincoln.

Planters' Friend (Row 4), Sorghum saccharatum (Row 7), Early Amber Cane (Row 3), and Kaffir Corn (Row 5), are the best known local varieties, and were included to enable comparisons of the imported varieties to be made with them.

NOTES ON THE VARIETIES.

Row 18.—Lincoln:—Tillers fairly well. The stems are fine, with medium-sized dark green leaves. The fodder is fairly sweet. It attained a height of 7 feet 6 inches. The heads are medium size, 6 to 7 inches in length, spreading, but fairly dense, with small brown seed.

Row 16.—Johnson, No. 12:—Tillers well. The stems are medium size, bearing a large number of medium-sized dark green leaves. It reached a height of 6 feet, and is fairly sweet. This is one of the latest varieties. The heads are very large, 9 to 10 inches long, compact, and very tapered, with reddish-brown seeds.

* From their yields, in comparison with our best known local varieties, it looks as if some of these Texan sorghums are likely to prove worthy of wide cultivation. Few of them have a distinctive name, and to overcome this inconvenience, it has been arranged to call them after distinguished Americans.

Row 20.—Grant :—Tillers well. Medium-sized stems and leaves, which are green. It reached a height of 6 feet 6 inches, and is very leafy. The stems are pithy, and not sweet. The heads are fairly large, slender, and dense, with white seeds with black specks.

Row 9.—*Black Line Kaffir*, No. 1:—Tillers well. The stems and leaves are large and dark green. It reached a height of 8 to 9 feet, and was late in maturing. The stems are sweet. The heads are large, 8 to 9 inches long, loose, and slightly spreading, with white seeds with black specks.

Row 15.—*Pink Kaffir* :—This variety bears the same name as Row 13, but does not appear to be identical. It does not tiller well. The stems and leaves are large and dark green. It reached a height of 7 to 8 feet. The stems are slightly sweet. The heads are large, erect, slightly open, with pinkish-yellow seeds with black specks.

Grant.

Johnson.

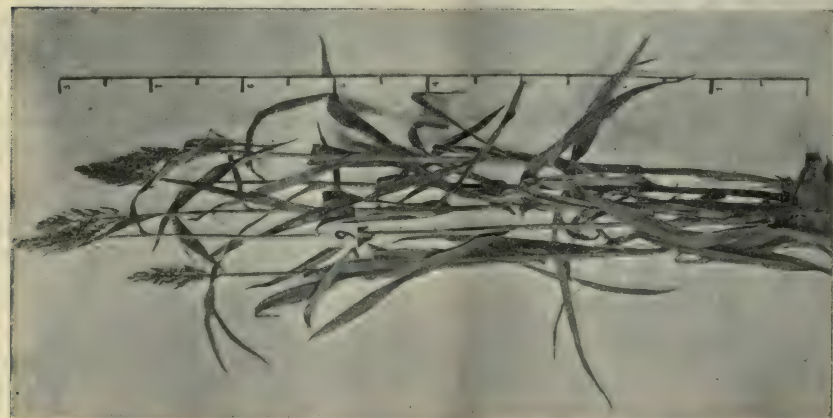
Row 19.—Hayes :—Tillers fairly well. Medium-sized stems and leaves, which are dark green. It is short, reaching a height of 5 feet only, and is very leafy. The stems are fairly sweet. The heads are of medium size, about 6 to 7 inches long, with spreading open panicles. The seeds are pinkish-yellow with black blotches.

Row 12.—Garfield, No. 9 :—Tillers fairly well, and has medium-sized stems with dark green leaves. It grew 7 to 8 feet high, and is succulent and sweet. The heads are of medium size, fairly dense, compact, and erect, with reddish-brown seed.

Row 4. — *Planters' Friend* (from local seed) :—Tillers fairly well. The stems are large, with dark green heavy leaves. It

Jefferson.

Pink Kaffir.



Black Line Kaffir.

grew to a height of 6 feet 6 inches, and has sweet stems. The heads are large, erect, compact, with brown seed.

Row 21.—Jefferson :—Tillers fairly well. The stems are fine, with medium-sized dark green leaves. It grew to a height of 8 feet, and is sweet. The heads are small, 6 inches in length, spreading and open, with red seeds.

Row 14.—Harrison, No. 10 :—This sorghum bears the same variety number as Row 13, but is not identical. It tillers well, and has medium-sized stems and leaves, which are dark green. The stems attained a height of 8 feet and are very leafy. They are sweet and succulent. The heads are long, slender, erect, and fairly dense. The seed is pinkish-yellow with black specks.

Row 10.—Jackson, No. 3 :—Tillers fairly

Monroe.

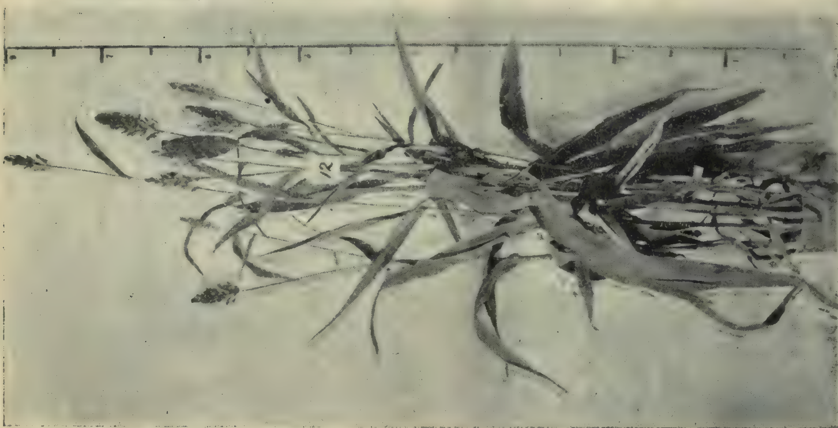
Harrison.

well. The stems are fine, with fairly large light green leaves. The stems grew to a height of 7 to 8 feet. They are pithy, and not sweet. The heads are small, erect, slender, with loose panicles and reddish-brown seed.

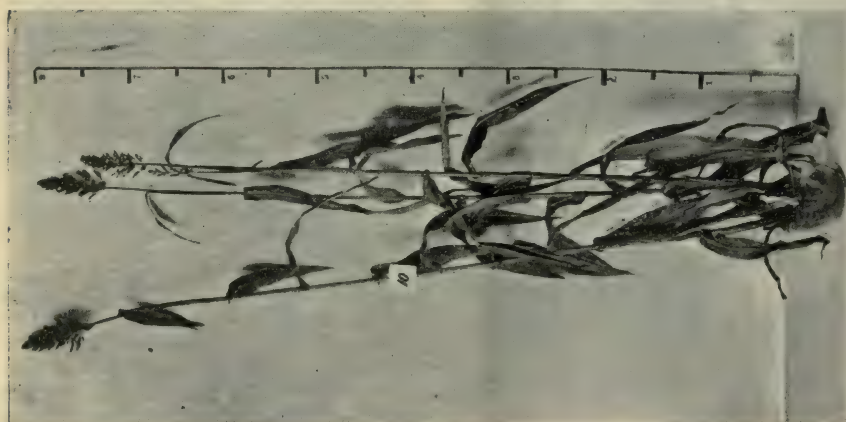
Row 7.—*Sorghum saccharatum* (from local seed) :—Tillers well. The stems are fine, with slender light green leaves. It reached a height of 6 feet, and is sweet and succulent. The heads are small, 6 to 7 inches in length, with loose, slender panicles. The seed is creamy white with black glumes.

Row 13.—*Pink Kaffir*, No. 10 :—Although this variety bears the same number as that grown in Row 14, it differs in its characteristics, and is evidently a distinct variety. It tillers fairly well, and has medium stems and green leaves. It reached a height of only

Hayes.



Garfield.



Jackson.

5 feet 6 inches, and is very leafy. The stems are dry, pithy, and not sweet. The heads are large, 8 to 9 inches long, with spreading panicles. The seed is pinkish-yellow with black specks.

Row 3.—*Early Amber Cane* (from local seed) :—Tillers well, and has fine stems with light green slender leaves. It reached a height of 7 feet, and is sweet and succulent. The heads are short, slender, panicles slightly spreading, with brown seed.

Row 11.—*White Kaffir*, No. 7 :—Tillers well. The stems are large, with dark green fairly large leaves. The stems reached a height of 5 feet and are very leafy. They are pithy, and not sweet. The heads are large, 8 to 9 inches long, panicles spreading, with white seed blotched with black.

Row 5.—*Kaffir Corn* (local) :—Stems and leaves are large and dark green. It is very

Pink Kaffir, 10.

White Kaffir.

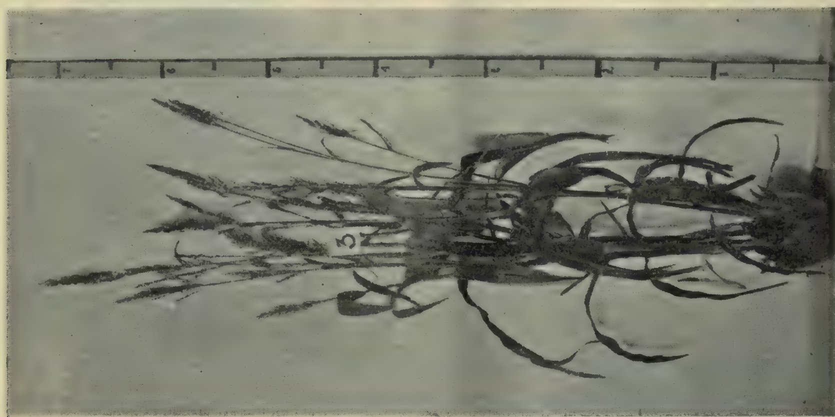
short, and only reached a height of 3 feet. The stems are pithy, and not sweet. The heads are about 7 inches long, erect and compact, with white seed.

Row 17.—Monroe, No. 15 :—Tillers fairly well. The stems are fine, with green slender leaves. The stems grew to a height of 5 feet, and are not sweet. The heads are very small, slightly spreading, with rather large, evenly shaped, bluish-white seed.

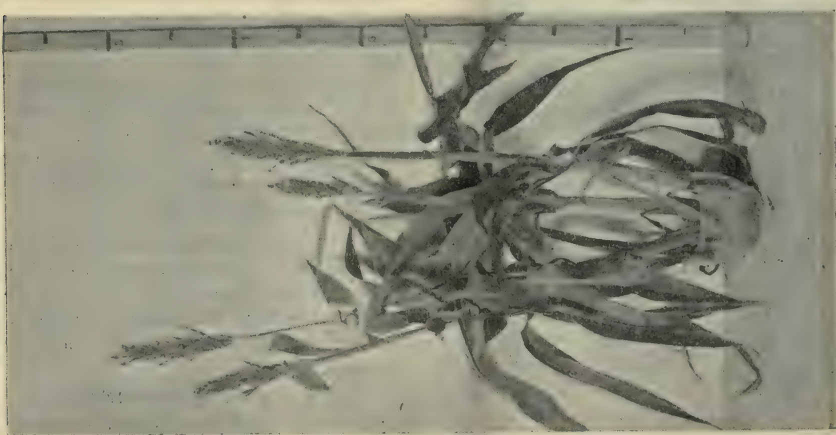
It will probably take the experience of five seasons to determine the real value of these varieties. By that time they will have become definitely acclimatised, and we will have knowledge of their constitutional qualifications.

A. H. E. McDONALD,
Experimentalist.

Sorghum saccharatum (local).



Early Amber Cane (local).



Kaffir Corn (local).

Report of the Manager, Experiment Farm, Wollongbar.

The seed of the thirteen varieties was sown in drills in well-cleaned and manured land, on 16th November, 1908. Ripe seed from each variety was gathered 3rd April, 1909.

Compared with the average growth of Planters' Friend, the heads of none of these American varieties carried 2 per cent. of the quantity of seed. Fresh heads have been growing from the upper nodes since 1st March, and some of the plants have as many as five heads bearing seed in all stages of maturity.

All the varieties were slower in growth than Planters' Friend.

Planters' Friend (local).

The following table shows the results in detail :—

Variety.	Weight of 10 stalks.	Height.		Stem.		Amount of leaf.	Seed.
				Sweetness.	Thickness.		
	lb.	ft.	in.				
Andropogon sorghum, 3b (Lincoln)	18	10	4	Good	Good	Fair	Indifferent.
Black Line Kaffir Corn	17	10	2	Fair	Good	Fair	Poor.
And. sorghum, 9 (Grant)	15	8	3	Good	Good	Good	Poor, late.
And. sorghum 3a (Jackson) ...	14	7	0	Fair	Good	Poor	,,
Pink Kaffir Corn	13	7	6	Fair	Fair	Good	,,
And. sorghum, 4 (Jefferson) ...	13	7	0	Fair	Fair	Fair	,, rusting.
And. sorghum, 15 (Monroe) ...	12½	6	0	Fair	Thin	Poor	,,
And. sorghum, 10 (Harrison) ..	12½	6	6	Fair	Fair	Fair	,, late.
And. sorghum, 12 (Johnson) ...	12½	6	2	Poor	Fair	Good	,,
And. sorghum, 1 (Garfield) ...	11½	7	0	Fair	Fair	Fair	,,
And. sorghum, 2 (Hayes)	10	6	6	Poor	Fair	Good	,, red inside.
Pink Kaffir Corn, 10	10	7	0	Fair	Fair	Good	,,
White Kaffir Corn	10	5	0	Fair	Fair	Fair	,, low percentage germinated.
Planters' Friend (local seed) ...	16¼	8	11	Good	Good	Good	Fair.

Samples of the two best grown—Lincoln and Black Line Kaffir Corn—were submitted to the Chemist for analysis, with the following results :—

ANALYSES of American Sorghums grown at Wollongbar Farm, compared with analyses of varieties commonly cultivated in New South Wales and Queensland.

—	1. Lincoln Andropogon Sorghum 3, Wollongbar.	2. Black Line Kaffir, Wollongbar.	3. Planters' Friend, Wollongbar.	4. Kaffir Corn, Wollongbar.	5. Planters' Friend.	6. Imphee.	7. Broom Millet.	8. Planters' Friend, Queensland.	9. Early Amber, Queensland.	10. Kaffir Corn, Queensland.
Moisture	48·72	39·22	22·31	52·51	73·32	73·91	41·41	74·10	78·90	70·82
Dry substance	51·28	60·78	77·69	47·49	26·68	26·09	58·59	25·90	21·10	29·18
Composition of Dry Substance.										
Ash	4·42	4·75	2·73	4·86	3·56	4·14	6·19	5·20	4·93	7·92
Fibre	16·47	23·46	15·27	26·51	22·71	22·00	39·10	....	....	....
Ether-extract (oil, fat, &c.)	2·67	1·83	2·66	2·13	2·05	3·80	1·01	7·72	6·07	7·47
Albuminoids	11·95	8·44	9·25	7·77	8·55	5·98	12·58	8·15	9·62	9·72
Carbohydrates	64·49	61·52	70·09	58·73	63·13	64·08	41·12	44·06	39·04	25·08
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	....	....	....
Nutritive value	82½	74	85½	71¼	76¼	78⅓	56	69½	62⅓	51½
Albuminoid ratio ..	1 to 6	1 to 7¾	1 to 8¼	1 to 8	1 to 8	1 to 12	1 to 3½	1 to 7½	1 to 5½	1 to 4⅓

Analyses of some of the sorghums commonly grown locally are attached for the sake of comparison. As the condition as to moisture content of these samples, when received, varied considerably, the analyses are in all cases calculated to give the composition of the dry substance in order that a fairer comparison may be made. Nos. 1 and 2 are the two sorghums from the United States. Nos. 3 and 4 are varieties obtained at the same time from Wollongbar. Nos. 5, 6, 7 are analyses of these grasses made at other times, and Nos. 8, 9, and 10 are taken from the report of Mr. J. C. Brünnich, Chemist to the Department of Agriculture, Brisbane.—F. B. GUTHRIE.

REPORT OF THE MANAGER, EXPERIMENT FARM, GRAFTON.

TRIAL of thirteen Varieties of Sorghums from United States at Grafton Experiment Farm, 1908–1909.

Variety.	Seed Packet No.	Sown.	Headed.	Harvested.	Yield.	Height. ft.	Height. in.
	No.	1908.				ft.	in.
Andropogon sorghum (Black-line Kaffir)	...	23 Sept.	Dec.	9 Feb.	......	6	6
,, ,, (Pink Kaffir) ..	...	23 ,,	,,	9 ,,	......	5	6
,, ,, ,, 10...	...	23 ,,	,,	9 ,,	......	5	0
,, ,, (White Kaffir) ...	7	23 ,,	,,	9 ,,	......	6	0
,, ,, (Harrison) ...	10	23 ,,	,,	9 ,,	......	6	0
,, ,, (Garfield) ...	9	23 ,,	,,	9 ,,	......	6	9
,, ,, (Johnson) ...	12	23 ,,	,,	9 ,,	......	5	0
,, ,, (Jefferson) ...	...	23 ,,	...	Nil.	Did not seed.	8	3
,, ,, (Jackson) ..	3	23 ,,	...	,,	,,	8	3
,, ,, ...	...	23 ,,	Dec.	9 Feb.	......	6	6
,, ,, (Lincoln) ..	...	23 ,,	,,	9 ,,	......	5	7
,, ,, ...	...	23 ,,	,,	9 ,,	......	5	6
,, ,, (Monroe) (bluish-white seed).	15	23 ,,	,,	9 ,,	......	7	2

The seed was all planted in drills 3 feet apart, and 4 inches between the seeds.

Rainfall from date of Sowing until Harvesting.—September, 81 points; October, 121 points; November, 333 points; December, 364 points; January, 54 points; February, 71 points.

Owing to the extremely dry conditions in January, these sorghums did not head properly, and in two cases no seed was saved. It is very hard to describe the different varieties when the plants do not mature properly.

I have a chance of getting a second crop of seed from these sorghums, as I allowed them all to grow up again after the cutting, and all of them are now heading, and if the frosts keep off a few weeks, I shall have plenty of seed for next trial.

Investigation of Bunt in Wheat.

The experiments which the Wheat Experimentalist, Mr. G. L. Sutton, is conducting this year, are designed to answer the following questions:—

1. To what extent do certain fungicides (enumerated below) destroy the spores of bunt or the seed grain, and so prevent the occurrence of the disease in the crop resulting from the planting of the treated seed?
2. Have these fungicides an injurious effect upon the vitality and vigour of the seed-grain?
3. Do these fungicides prevent re-infection to any appreciable extent?

The fungicides experimented with are:—

Formalin	25 per cent.
Bluestone	2 ,,
Bluestone	2 ,,
(and salt sufficient to make a saturated solution).	
Bordeaux mixture.	
Bluestone	2 ,,
(supplemented with an immersion in lime-water).	
"Fungusine," a proprietary preparation.	

Arrangements have been made to carry out experiments with three varieties of wheats (all bunt-liable) at the Cowra Experiment Farm, and at the same time the Director of the Bureau of Microbiology, Dr. Tidswell, will have 100 seeds of same varieties, treated identically the same as in the case of each of the field experiments at Cowra, grown in his laboratory. Plants grown in this way will serve as specimens for microscopic examination, as required in the early stages of the experiment, and during the later stages specimens can be taken from the field, as required.

Microscopic examination of the growing plant will be made at fortnightly intervals, from germination to maturity.

Wheat-growers will be gratified to learn that Dr. Tidswell will devote as much time as possible to the investigation of not only bunt in wheat, but other diseases that have caused serious loss from time to time.

Swine Fever.

SWINE fever has now been recognised in this State for about six years, and only the rigid enforcement of quarantine regulations and the immediate slaughter of affected and in-contact pigs have prevented the disease from being a serious menace to the pig industry, as will be comprehended from a brief reference to its history.

History.

Available evidence points to the disease having been introduced into Great Britain from the Continent of Europe at some date prior to the year 1853. In the year 1862 the disease was found by Professor Simonds, of the Royal Veterinary College, among home-bred pigs on a farm near Windsor. Shortly after, it appeared in a widely disseminated form, and is stated to have caused a mortality often amounting to 75 per cent. of the affected pigs.

In 1878, Klein described under the name of "infectious pneumo-enteritis" a swine epizoötic in which the lungs, serous membranes, and intestines were specially affected. This pneumo-enteritis of Klein is identical with swine fever, as it agrees with it perfectly, clinically as well as anatomically. During the following year the disease was reported to exist in nearly every county in England, six in Wales, and three in Scotland, there being 2,765 outbreaks and over 17,000 swine attacked. In 1885, the disease attacked 40,000 pigs, of which 27,000 were killed and 10,000 died, while in the following year 35,000 died of the disease.

The Board of Agriculture received from Parliament on the 1st November, 1893, powers to order the slaughter of swine suffering from swine fever, and of swine that had been exposed to the contagion of this disease. The number of pigs that had been slaughtered as belonging to these two classes were as follows:—17,774 in year 1893; 56,296 in 1894; 69,931 in 1895; 79,586 in 1896; and 40,432 in 1897. Since then, notwithstanding the various measures enforced for its eradication, swine fever has affected the pigs in Great Britain each year with greater or less virulence.

At the present time it is, if anything, increasing in prevalence in Great Britain, as during the first three months of the present year there were 333 outbreaks, and 2,877 pigs were slaughtered, whilst for the corresponding period of last year only 1,645 pigs were killed, though the outbreaks were more numerous, viz., 364.

STOCK BRANCH LEAFLET, No. 6.

The disease is stated to have made its first appearance in America, in the county of Ohio, in 1833. During 1877 and 1878, a generally disseminated swine plague raged for the first time in North America. Detmers, in Chicago, termed it "swine plague"; Law, in Ithaca, "hog fever"; and the farmers, "hog cholera." The total loss in 1885 to the United States was estimated at 30,000,000 dollars. In Nebraska alone, 400,000 pigs died in Missouri, 200,000; and in Indiana, 400,000 during the year.

Although the disease existed in Germany and Austria before 1882, its nature was not recognised until Löffler and Eggeling elucidated it at that time. At the present day it is the most widely disseminated and most dangerous porcine disease in Germany.

In 1887, swine fever spread first to Sweden and then to Denmark, and from that period the epizoötic became widely disseminated, particularly in Prussia, Hungary, and Servia. It was also introduced into France.

As regards Australasia, we now have records of its appearance in all States of the Commonwealth and New Zealand.

According to Mr. J. A. Gilruth, M.R.C.V.S., Chief Veterinarian and Bacteriologist to the Government of New Zealand, the first suspicion he entertained of the presence of swine fever among the pigs of that country was in the summer of 1894-95. The existence of the disease was officially announced shortly after this, outbreaks having occurred at several centres. Vigorous prophylactic measures were at once put into operation, and in the course of time the disease was regarded as stamped out. It, however, reappeared during December, 1901, in a piggery connected with one of the State institutions after an apparent absence of twelve months, inquiries failing to adduce any satisfactory explanation as to how it was introduced. In his report, Mr. Gilruth strongly advocates the complete inspection of all the pigs in the colony, and, until this is carried out, it is impossible to state what degree of success has attended his effort to eradicate the plague.

With respect to Queensland, an outbreak of swine fever at Mackay was reported by Mr. J. McLeod, M.R.C.V.S., in August, 1899, and an odd case was subsequently reported to have been found in the vicinity of Brisbane. By slaughtering all the affected swine, quarantining the premises for six months, and exercising the usual precautionary measures, the Chief Inspector of Stock of that State claimed to have eradicated the disease a little over twelve months after its first appearance. A further outbreak occurred later near Brisbane, but its reappearance was regarded by the Queensland authorities as being due to the introduction of diseased pigs from this State.

The first serious outbreak which was officially dealt with here occurred in 1903, at Bondi; but when it was first introduced into the State is not known. Since then the disease has always been present, though, as before

stated, quarantine and slaughter have kept the disease well within bounds. Last year nine outbreaks were dealt with by the officers of the Stock Branch, and this year five have so far occurred.

The slightest relaxation of the regulations at present in force would undoubtedly result in the disease sweeping through the country and practically paralysing the industry.

Nature and Cause.

Swine fever is also known as "swine pest," "swine typhoid," "hog cholera," and "contagious pneumo-enteritis." It is a very malignant and extraordinarily infectious disease.

It was for many years held that the causal organism was a short ovoid bacillus, which was known as the "bacillus of swine fever"; but the recent investigations of Dorset and McBryde, in America, show that although this organism is almost constantly present, and has considerable pathogenic power for pigs under certain circumstances, it cannot reproduce the disease in all its manifestations. Their experiments show that there is in the blood of affected animals some other organism, so minute as to be invisible with the microscope, which is the real causal organism. It is probable that the so-called bacillus of swine fever is a constant inhabitant of the intestines of pigs, and that when the vitality is lowered by an attack of the ultra-visible organism, or possibly by some other agent, the bacillus of swine fever is enabled to cause disease.

Cause.—The sole cause of the disease is the introduction into the animal's system of the specific micro-organism derived from a previous case of the disease. Exhaustion and exposure to cold and wet predispose swine to infection by lowering their vitality. Hardship and adverse influences in general may accelerate a latent infection, while insanitary conditions favour the development of the disease once it is introduced, and tend to increase its virulence.

Mode of Infection.—The chief channels of infection are the alimentary and respiratory tracts, the former more commonly. The mode of infection is considered by some authorities to determine the form assumed by the disease; thus pulmonary form originates from infection by inhalation, and enteric from infection through the mouth by ingestion. Other authorities, however, do not consider pneumonia a constant manifestation of swine fever. Professor McFadyean states that "with our present knowledge, we are unable to say whether pneumonia when it occurs in the course of swine fever is an adventitious complication or a consequence of the action of the swine fever germ."

In very many cases the two forms occur concurrently, though in some in which the lungs are markedly infested the intestinal lesions may show only small areas of congestion in the stomach and about the ileo-cæcal

valve, accompanied by a hæmorrhagic condition of the mesenteric lymphatic glands.

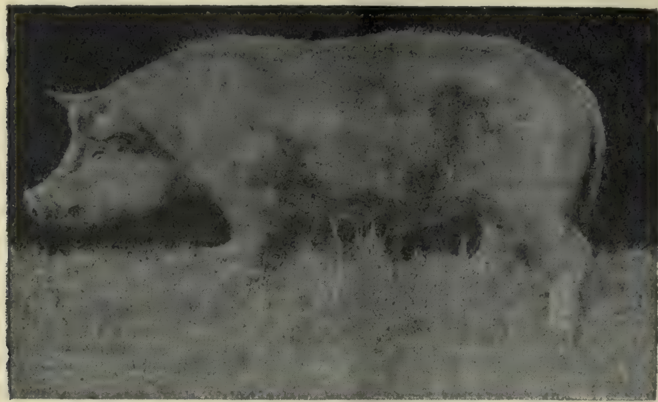
Period of Incubation.—The period of incubation of the disease under ordinary conditions varies from one to three weeks.

Symptoms.

Swine fever does not run a uniform course. In the same lot of pigs entirely different symptoms and forms of the disease may appear simultaneously. Owing to the variations shown in the manifestation of the disease, a typical description of the symptoms cannot be furnished under one heading. For practical purposes, it is clinically divided into a per-acute, an acute, and a chronic form.

1. Per-Acute Form.—This form is very severe, and commonly causes death in from three to eight hours. It usually attacks pigs from 3 to 6 months old and fat stores, and consists of a highly feverish hæmorrhagic inflammation of the lungs or of pure septicæmia. An animal that has just fed with a good appetite becomes suddenly and extremely ill. It suffers from shivers, staggers, and falls down. The temperature rises to 106° or 108° F. The pulse becomes frequent and irregular, while beating of the heart is almost imperceptible. Respiration is difficult and accelerated. Frequently a moist cough is present. There is great prostration. Sometimes a mucous discharge and bleeding from the nose is present. Red spots often appear on the skin about the ears, on neck, breast, and abdomen. Pressure over the region of the stomach gives pain, and the animal shows an inclination to vomit. The bowels may be tympanitic, and as a rule there is a certain amount of constipation present. The per-acute may pass into the acute form.

2. Acute Form.—The acute form of swine fever usually appears as a pneumo-intestinal inflammation, which is sometimes complicated with various kinds of exanthemata of the skin. It is also a fatal form, and its duration varies from a few days to about three weeks. An affected pig is not easily roused, and generally does not readily answer the call of the attendant or the noise of the feed bucket as healthy pigs usually do. It is noticed to be the last to move at feeding-time, and to walk up unsteadily in a dazed and drowsy manner. It exhibits little or no interest in what is taking place around it, and soon retires to seek quietness, rest, and shelter. Frequently there is a desire to vomit, the attempts sometimes being successful, but more often they are abortive. Thirst is always evident. The affected animal may be observed to lick at any available moisture, such as wet patches that collect in the crevices and depressions in the flooring of many sties. The back is arched, the head carried low, ears drooped, and the tail uncurled and limp. The eyes become sunken, and a sticky discharge escapes from the eyelids, to which sand and dirt adhere, giving the eye a peculiar appearance that at once attracts attention. There is rapid loss of flesh, the ribs and spine become evident, and the flanks tucked up.

1 

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Nos. 1, 2, and 3.—Photographs of Pigs affected with the acute form of Swine Fever, showing characteristic appearances at different stages.

No. 1 had been affected about five days; No. 2, ten days; and No. 3, fifteen days.

Loss of muscular power gradually becomes apparent, and is especially noticeable in the loins and hind part of the body. The gait becomes staggering, the animal steps short and uncertain, while the body sways from side to side. If compelled to remain standing in one position for a minute or two, the whole body is seen to tremble or shake, particularly the muscles of the shoulders and thighs.

There is usually a pronounced fever, and the thermometer is consequently of great assistance in the detection of affected animals. In the early stages, when the fever is high, the bowels are usually constipated, although at the very outset a transient diarrhœa may be present. As the fever subsides, a more or less persistent diarrhœa sets in, the motions become frequent, and the dejecta vary in colour from black to grey, green, brown, or yellow, have an offensive odour, and are often viscid in nature, adhering to the sides of the buttocks and the tail. In the latter stages the motions are watery, and often the animal strains violently without any evident result. The stools at times are streaked with blood, and large clots of blood may be mixed with the fæces or passed alone. During the fever the urine is scanty and high-coloured. As recovery takes place it becomes abundant and watery.

In grave cases, necrotic ulcers form inside the lips and on the gums and tongue. Abortion is of common occurrence. In sows suckling their young the milk supply is diminished or completely arrested, while the suckling pigs often die suddenly.

Pulmonary Symptoms.—The pulmonary form of the disease is first manifested by a short, dry, painful cough, which speedily becomes spasmodic, and occasionally lasts so long as to threaten suffocation. The breathing becomes of a heavy pumping or panting nature, and the white of the eye becomes dark red in colour. The discharge from the nose is often frothy and profuse, while at other times it is scanty and glary (muco-purulent). Dull percussion sounds may be obtained over the chest wall, and auscultation proves the existence of suppressed respiratory murmurs. Occasionally symptoms of pleurisy and pericarditis become evident.

Changes in the Skin.—In many cases the skin shows no striking changes. In others there are more or less well-marked local symptoms of the disease, the most common being patches of red, dark red, or bluish colour on the ears, under the neck, chest, and abdomen, inside the forearms and thighs, and about the anus. These patches vary in size from that of a pea to a sixpenny piece, being most commonly well defined, but occasionally becoming confluent and forming irregularly shaped areas of discoloration. As the disease advances, the patches become darker, and in rare cases the involved skin dies and sloughs off, leaving ulcerous-looking sores.

3. Chronic Form.—The chronic form of swine fever may develop insidiously, or be the result of an acute attack. Its average duration is from four to eight weeks, but sometimes it persists for months. The

eyes become dull and slightly sunken, the upper lids having a peculiar appearance owing to loss of hair and desquamating cuticle. A sticky secretion is discharged from the edges of the lids, and the skin of the forehead becomes wrinkled. The hair (or bristles) stand somewhat erect, the back arched, the tail limp and often straight, the ears dropped forward, and the animal exhibits a generally dejected appearance. Usually there is constipation, alternated with diarrhœa, which occasionally becomes persistent, profuse, and fœtid, and rapidly brings the illness to

4

5

Nos. 4 and 5.—Photographs of Pigs suffering the chronic form of Swine Fever

a fatal termination. The affected pigs may eat a good quantity of food, but they never improve in size or condition. They eat with avidity, but are soon satisfied, returning to finish their meal after an interval of rest. When the lungs are extensively affected, there is a chronic cough and persistent breathlessness, together with great and continual emaciation. The skin usually has a scurfy appearance, without any discoloration. As the disease advances, the animal loses condition, especially about the hind-quarters, becomes anæmic, and shows great weakness and signs of paralysis.

Although the above symptoms are usually manifested, it is well known that a certain percentage, especially the older animals, affected with chronic lesions of swine fever do not exhibit any distinct symptom of illness. They may appear to be in good health and keep in fair condition. Pigs so affected are a constant source of danger, as they are liable to suffer a recrudescence or exacerbation of the disease. Moreover, they are capable of spreading contagium by means of their dejecta. Breeding sows affected in this manner commonly abort, the act not being accompanied by more than slight indications of ill-health.

Post mortem Appearances.

Although the most conclusive evidence of the existence of swine fever is usually discovered on *post-mortem* examination, there is as great variety in the anatomical changes as in the symptoms.

In the per-acute form, only the general changes of septicæmia (or blood-poisoning) may be found, without any distinctive local lesions. At other times the lesions approach those seen in the acute form.

In the acute form the condition of the carcass may vary from prime to extreme emaciation. Discoloration of the skin may be evident or entirely absent. There may be a frothy discharge from the nose and evidence of a recent diarrhœa about the hind-quarters. The eyes are sunken, and a viscid discharge often adheres the eyelids together. The lips, gums, tongue, hard palate, and back part of the throat occasionally show punctiform hæmorrhages, ulceration, or areas of necrosis.

On incising the abdominal wall, inter-muscular hæmorrhages may be seen, and the blood-vessels are found engorged with dark blood that does not form a firm coagulum. A quantity of fluid may be found in the abdominal cavity, usually of a straw color, but may be turbid. The peritoneum may show petechiæ,* or signs of congestion, or of having suffered from a fibrinous inflammation, which, in advanced cases, adheres the intestinal loops together. The mesenteric lymphatic glands are enlarged, dark, and hæmorrhagic in the per-acute and acute types of the disease, while in chronic cases they may undergo caseation.

Stomach and Intestines.—The lesions in connection with the digestive canal may be described as existing in three forms, *i.e.*, hæmorrhagic, the ulcerative, and the diphtheritic.

The hæmorrhagic type corresponds to the initial stage of ulceration, and is accepted as the earliest indication of the disease. The stomach, bowel, or other part affected is beset with numerous petechiæ, which may be scattered over the entire length of the alimentary tract, and are usually marked in the large intestine, where their appearance is very characteristic. Accompanying this condition, it is not uncommon to find the stomach, bowel, or both presenting a condition of intense congestion, with a sero-fibrinous exudate between the mucous and submucous coats.

* Small capillary hæmorrhages somewhat resembling a flea-bite.

The small capillary hæmorrhages which precede the ulceration are determined by the presence of the swine fever bacillus. The epithelium covering the petechiæ soon becomes separated and removed, leaving a minute surface of ulceration. In a few instances the small ulcer heals, but usually, owing to the continued presence of the specific irritant—the bacillus of swine fever—the involved tissues become necrosed, and the process extends. The extension affects the mucous coat and underlying structures, in consequence of which a well-defined lesion is formed, known as a "swine fever ulcer." Although ulceration takes place in the initial stage of its production, the lesion is really a more or less circumscribed circular area of necrosis.* But when recovery is taking place, and the

No. 6.—Photograph of Lesions found in large intestine.

A Ilio-cæcal valve. B Necrotic mass above valve. CC Typical ulcers of Swine Fever in various stages of development.

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* Death of the involved tissue.

necrotic tissue becomes detached, the slough passing out with the dejecta, a true ulcer may, however, be found as a round depression in the mucous membrane.

Even in the same outbreak there is great variation in the number, size, shape, and colour of the so-called ulcers of swine fever. They vary in number from one to hundreds, and in size from that of a mere speck to that of a five-shilling-piece. Occasionally a superficial ulceration involves large areas of the mucous membrane. They may be circular, oval, or irregular, occurring widely separated or in rows or clusters. The large, irregular-shaped areas of necrosis frequently met with are probably due to the coalescence of several smaller areas. The colour varies from lighter or deeper shades of yellow to grey, green, brown, or black, the darker shades being due to the action of bile pigments and colouring agents in the intestine. Its intensity depends on the age of the lesion.

It is very rarely that the ulceration leads to perforation of the wall of stomach or bowel, for, as the necrosis extends superficially or, as is often the case, into the deeper tissues, an increase takes place in the underlying fibrous tissue. The bowel wall may thus become greatly thickened throughout a considerable portion of its length, while its lumen is perceptibly narrowed. At other times this abnormal development of fibrous tissue is localised to that part of the wall immediately beneath the necrotic area, and as it grows it pushes the surface of the so-called ulcer until it protrudes well above the surrounding healthy tissue into the lumen of the bowel. These prominent circular lesions constitute what are commonly termed the "buttons of swine fever." In some very old cases of disease they have a greater resemblance to the shape of a mushroom than to that of a button.

The diphtheritic form of the disease is characterised by the formation of a yellowish ashen-grey exudate or deposit of fibrin on the inner surface of the stomach or intestine, accompanied by a necrosis of the immediate underlying tissue. The exudate may be sparing or abundant in amount. In the early stages it is so thin as to be almost entirely removed by washing; but in time, under ordinary circumstances, it becomes firmly adherent to the mucous surface, and presents a firm, tough, yellowish-grey or, in old cases, black surface, slightly raised above the surrounding normal tissue. The involved portion of the bowel may be very limited or extend to a considerable length.

The above-described necrotic and diphtheritic changes are mainly found on the inner surface of the stomach and large intestine, particularly that of the latter, about the protuberance formed by the passing of the small intestine into the large bowel, and known as the *ilio-cœcal valve*. As a rule, they are distinctly evident, but occasionally, and especially in cases that have run a rapid course, they have to be sought for diligently. The whole length of the alimentary tract must be opened up, washed, and carefully examined before one can be satisfied as to their absence.

The stomach or bowels are often found inflated with gas, and the contents of the large bowels offensive and pasty, adhering to the knife like putty.

The Lungs.—These organs may or may not be affected in the acute and chronic forms of the disease. When they are affected they show specific changes.

On opening the chest cavity, indications of pleurisy may be observed, and the lung found adherent to the chest wall or diaphragm, while the cavity may contain a more or less copious quantity of fluid, which may be clear and watery, or opaque and mixed with flakes of lymph.

The lungs may be enlarged, heavy, and engorged with blood, while the lobules are mapped out by an inter-lobular effusion somewhat resembling in appearance that seen in contagious pleuro-pneumonia in cattle. The smaller tubes and the bronchi, as well as the windpipe, may contain a frothy, serous, or sanious liquid. The blood-vessels may contain dark blood clots.

The appearance of a multiple gangrenous pneumonia is held by some authorities to be characteristic of swine fever. Hepatised areas are found, particularly in the anterior lobes and at the roots of the lungs, which are solid to the feel and in colour vary from dark red to greyish red. On cutting through the thickness of a hepatised area it may be seen to have a slightly granular appearance, due to numerous small yellow or buff coloured caseous circumscribed foci or spots, which, in acute and chronic cases, often increase in size to that of a hen's egg. The yellow deposits are dead portions of the lung tissue.

The bronchial and mediastinal glands are usually greatly swollen, congested, and moist, and have a mottled appearance.

Other Organs and Parts.—The pericardium usually contains a considerable quantity of fluid, which may be faintly yellow and watery or opaque and blood-stained. In some epizoötics a fibrinous pericarditis occurs, which occasionally leads to adhesion of the pericardium to the heart. The heart frequently shows punctiform hæmorrhages, particularly noticeable on the auricles and along the ventricular groove. On incising its cavities soft, dark clots of blood are usually found, occasionally a white clot (*ante-mortem*) is present. Numerous spots of extravasated blood are seen under its lining membrane, especially about the elevated portions (*musculi papillares*) of the left heart.

The upper part of the windpipe—larynx, and particularly the epiglottis, is frequently the seat of well-defined punctiform hæmorrhages, and occasionally of well-marked typical ulceration, while the lining membrane of the œsophagus (or gullet) and of the trachea (or windpipe) often show numerous petechiæ. Sometimes the œsophagus is the seat of diphtheritic and necrotic lesions.

The liver and spleen are often dark and congested, and occasionally small necrotic areas are found present.

The kidneys are not uncommonly inflamed, and show numerous pin-prick-like hæmorrhages, some of which may be seen through the kidney capsule.

The Fatality of the Disease.

The fatality varies a good deal. Young store pigs from 3 to 6 months old, and fat pigs from 6 to 12 months old, as a rule, rapidly succumb. Pigs over 1 year old, although occasionally suffering an acute attack and dying rapidly, usually survive the fever or become subjects of the chronic form. In herds where the per-acute and acute types predominate, the fatality usually ranges from 50 to 95 per cent. In general, it is great where insanitary conditions prevail. As a rule, the chronic form is not so fatal.

How the Disease is Spread.

The disease is spread by every means calculated to take part in the dissemination of the micro-organism.

The principal agents in this dissemination are diseased pigs, the origin of the majority of outbreaks being directly traceable to the introduction

No. 7.—Photograph of Sow recovering from the chronic form of Swine Fever.

No. 8.—Photograph of a Sow that suffered a mild attack of Swine Fever and recovered.

It is pigs of the kind illustrated in No. 6 and No. 7 that are mainly instrumental in the spread of the disease.

of pigs purchased at auction sale. In this connection pigs affected with the chronic form of the disease deserve great attention. There are many cases of obscure or chronic forms of the disease in which the morbid changes go on slowly for many weeks or months, and finally attain an excessive state of development without being attended by any of the symptoms usually regarded as diagnostic of swine fever. Some very important information in regard to this phase of the disease was obtained by the Departmental Committee appointed by the Board of Agriculture of Great Britain, in 1895, in connection with the examination of swine which had been isolated for two months on infected premises. At the end of that time they were certified as being free from disease, and would in the ordinary course have been released. In several of these instances the pigs were slaughtered, and characteristic lesions of swine fever were detected on *post-mortem* examination. The committee further found that swine placed in contact with affected pigs, or in sties that had been occupied by diseased animals, became affected with a similar type of slowly progressive disease, and, on *post-mortem* examination, that there existed a great disproportion between the well-advanced lesions in the digestive canal and the slight symptom of disease exhibited during life by the animal.

The introduction of sows and boars for breeding purposes is another common method by which swine fever is spread from one piggery to another, while pig-dealers, attendants, butchers and their appliances, together with their boots and clothing, are occasional agents in the spread of the disease.

Railway trucks, carts, crates, &c., used in the conveyance of diseased swine, may carry infection, while sty utensils are regarded as even more dangerous.

It is probable that rats and birds may carry the contagion from one sty to another, and, no doubt, dung and sweepings from infected premises may be spread broadcast by the wind. Flies must also be recognised as active agents in the spread of the disease to neighbouring sties.

Measures recommended for the Prevention and Suppression of the Disease.

Introduction of New Stock.—Before acquiring new animals they should be carefully examined, and inquiries made as to freedom from disease of the locality from which they are to be taken. Pigs intended to be introduced into the piggery should be isolated some distance from the herd, and kept under observation for at least four weeks. If there is no history of their having been in contact with the disease, and they manifest no signs of sickness during the period they are isolated, they might be admitted into the piggery.

Care with Visiting Pigs.—Under no circumstances should sows or boars visiting for breeding purposes be admitted into the piggeries. Special sties in an isolated position should be erected for their use. Swine that have been in contact with visiting pigs should be treated as new stock before being permitted to return to the piggery.

Immediate isolation of sick pigs.—In connection with all large piggeries, it is advisable to establish a hospital sty some distance from where the herd is kept, to which any pig showing signs of ill-health should be removed and kept under observation.

Slaughter of affected pigs.—All pigs that are suffering, or suspected of having suffered, from swine fever should be immediately slaughtered and totally destroyed by fire. All blood and discharges that come from them should also be burnt, and lime scattered over the ground where they have fallen.

Treatment of in-contact pigs.—As pigs that have been in contact with affected animals are the chief agents in propagating infection, it is always advisable to send such animals to the slaughtering houses as soon as practicable. All carcases that are sound will be passed by the inspector, and the pork may be sold for human consumption. Should the in-contact pigs be retained, the majority will probably, in the course of a week or so, develop the disease, infection spread to other sties, and the whole of the herd in course of time become affected.

Disinfection of infected sties, yards, &c.—Sties in which pigs have developed the disease should be subjected to most thorough cleaning and disinfection. All dirt and refuse must be removed and destroyed by fire, the floors and gutterings repaired and made impervious, the troughs treated with boiling water, and the whole of the buildings, floors, and fences painted with freshly-made lime-wash. It is recommended that the lime-wash be made in the proportion of half a pound of fresh unslaked lime to one gallon of water, to which is added a cupful of crude carbolic acid. The buildings should be allowed to remain idle for at least three months, and be again lime-washed before they are restocked. Where they are old and dilapidated, the advisability of burning them should be seriously considered. Utensils such as brooms, shovels, rakes, &c., used in infected sties, should be thoroughly cleaned and disinfected with boiling water containing carbolic acid.

The yards or runs in which affected pigs have been enclosed should be top-dressed with lime, and then dug or ploughed up, and the fencing treated with lime-wash.

That infection may be spread by the clothes and boots becoming soiled indicates that the attendants should be compelled to change these articles after entering an infected sty, and wash them in water containing carbolic acid.

General sanitation.—All sties should be swept out and the yard raked over at least once daily, and the filth and refuse at once done away with. Wooden feeding troughs should be replaced by others made of cement or metal, securely erected on impervious platforms. Drainage should receive attention, and a good supply of water for cleansing and drinking purposes acquired. The coppers or vats used for boiling food should be kept clean, while bones and rubbish should not be allowed to accumulate. All buildings and fences of the piggery should be periodically, and at least once a fortnight, treated with newly-made lime-wash.*

Management of herd.—Every owner should endeavour by careful management to breed strong and healthy pigs. In feeding them it is desirable to boil all kitchen refuse. Pigs do best on a mixed diet.

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* A spray pump will be found of great service in distributing the lime-wash.

Chemical Notes.

F. B. GUTHRIE.

Pea-nut and Bean Cakes.

A sample of pea-nut cake from Java was analysed in the laboratory some time ago. The figures were as follows:—

Moisture	16·02
Ash	4·58
Fibre	4·40
Albuminoids	45·25
Carbohydrates	17·33
Ether extract (fat and oil)	12·42
	100·00

Nutritive value	70·5
Albuminoid ratio	1 to 1

The ash is rich in phosphates and potash salts, and the cake has a fairly high value as a manure, the proportions of manurial constituents in the cake being as follows:—

Nitrogen	7·24
Potash	1·17
Phosphoric acid	1·46

The manurial value of this at the current market rates would be about £5 6s. per ton.

Pea-nuts are extensively grown for food in many countries, especially in Senegal, Algiers, Egypt, and the United States. They produce a large proportion of an edible oil, which is used like olive oil for table purposes, and in the Southern States of America large quantities are grown for the sake of this oil. In South Virginia about 100,000 acres are under cultivation, and the whole of the harvest in Virginia and Carolina amounts to 7,000,000 bushels, of a value of £3,000,000.

The residue from which the oil has been pressed is valuable as a cattle food, as the analysis given above will show, since it is highly nitrogenous and still contains a considerable proportion of oil.

The composition of the original hulled nut is as follows, according to Wiley, though it varies in composition in different localities.

Water	9·2
Ash	0·9
Fibre	2·5
Albuminoids	25·8
Carbohydrates (sugar, starch, &c.) ...	24·4
Oil	38·6
	101·4

It is one of the richest of the nuts from a food point of view, and is particularly rich in oil and nitrogenous matter.

Pea-nut is a crop which deserves consideration in this State, as it is of easy cultivation, prolific, and can be grown under a considerable variety of soil and climate. It produces a palatable and nutritious nut, a valuable oil, and the pressed cake is just as good for fodder or manure as the corresponding cakes obtained from linseed, coco-nut, cotton-seed, &c.

Trials at the Experiment Farms at Richmond and in the North Coast, have proved very successful.

Mr. S. A. Andrews, writing in *Tropical Life*, states that "it will grow under a great variety of climatic conditions, provided there is a season of at least five months free from frost. The weather conditions most favourable to maximum production are an early spring; warm, even summer temperature, with a well-distributed rainfall, and a comparatively dry autumn."

A comparison of the composition of some other seeds which are valuable for the production of oil, and of feeding-cake prepared from them, is subjoined :—

	Flax Seed.	Linseed Cake.	Cotton-seed Kernel.	Cotton-seed Cake.
Moisture	9·2	9·2	6·9	8·6
Ash	4·3	5·4	6·9	7·0
Fibre	7·1	8·6	4·8	4·9
Albuminoids	22·6	36·6	30·3	44·1
Carbohydrates	23·1	37·0	21·5	21·2
Ether extract (fat and oil) ...	33·7	3·2	29·6	14·2

A similar product from China has also come under our notice.

It is obtained from a small green bean grown in North China and Manchuria. These beans are rich in oil, and the oil is expressed in stone-mills and presses and used as a lubricant and, in China, for cooking. The cake left after expressing the oil is pressed into large discs about 2 feet diameter and 6 inches thick and weighing about 42 to 48 lb.

It is ground up and used in the East as a manure. It is also used, but less extensively, as a fodder. An analysis of a portion of one of these cakes shows it to be a highly nitrogenous food very similar in composition to the pea-nut cake.

The following is the analysis :—

Moisture	14·52
Ash	5·16
Fibre	4·03
Albuminoids	42·31
Carbohydrates	25·25
Ether extract (fat and oil)	8·73
	100·00

Nutritive value ... ... 87·3

Albuminoid ratio ... ... 1 to 1·06

The ash is rich in potash salts and phosphates, and the manurial value is shown by the proportions of fertilising ingredients which are, as follows, in the whole cake:—

Nitrogen	6·77 per cent.
Potash	2·00 ,,
Phosphoric acid	1·33 ,,

Bleached Wheat.

A quantity of grain was bleached by Mr. Norris by exposure for six days (February 22–28, 1906) in the open.

The weather was unsettled during this week, and the grain was alternately moist from rain and dew and dried by the sun.

The bushel-weight of the original grain was 64½ lb. (taken on one of Dell's chondrometers).

In taking this weight, the funnel was filled and striked before the grain was run into the bucket. The whole of the grain was then exposed to the weather. After exposure, the volume of the grain had increased so that there was now more than necessary to fill the funnel. The bushel weight of the bleached grain was only 54¾ lb., or a loss of 9¾ lb. per bushel on bleaching.

The weight of the individual grains had increased under the bleaching process, as the following figures will show:—

Weight of 100 grains	3·2990 grammes.
,, ,, (bleached) ...	3·3604 ,,

The effect of bleaching in the above instance is of course exaggerated, that is to say, marketable wheat which has been bleached under ordinary conditions would not receive quite such severe treatment as was purposely given to the sample described above.

A bleached sample of Bobs wheat grown at Tenterfield was examined.

The sample was taken from a crop which had 6 inches rain on it after ripening. The grain was large and plump, with a dullish white appearance, and weighed 59¾ lb. per bushel. When milled it yielded 72·5 per cent. of flour which was of fair colour, contained 9·5 per cent. gluten, and had a strength (water-absorbing power) of 47 quarts per 200 lb.

An unbleached sample of Bobs grown in the same year in Glen Innes, a similar district, had a translucent appearance, hard, small, plump, weighing 64¾ lb. per bushel. When milled it yielded 70·2 per cent. of flour—flour of good colour—with 8·7 per cent. gluten, and a strength of 48·8 quarts per sack.

From this it appears that naturally bleached wheat, especially wheat of the strong-flour varieties, though considerably lower in bushel weight, is not so very seriously deteriorated in milling quality.

Intestinal Calculus (Horse).

Analyses of calculi have shown them to vary considerably in composition. A great number of acids and bases may be present in these products, but they are for the most part mixtures of some of the following substances:—Uric acid and urates, phosphates, carbonates, oxalates, and hippurates in combination with lime, magnesium, ammonium, iron, and the alkali metals; the most common forms being a mixture of uric acid with ammonium or calcium urate; ammonium magnesium phosphate with phosphate and carbonate of lime; phosphates with either uric acid or oxalic acid. It is, however, unusual for a calculus to be composed exclusively of a single substance, and on this account the analysis by Mr. Ramsay of an intestinal calculus, forwarded for examination by the Stock Department, may be of interest.

The calculus in question was one of a considerable number found in the droppings of a horse belonging to Mr. Bowden, Cliftlands, Scone. The horse had been running at grass. The substance was oval-shaped, about 2 inches in length and about 1 inch across its longest diameter. On cutting through the centre, the nidus was found to consist of a small piece of steel like a portion of a broken knife-blade. The following is the analysis of the calculus:—

Intestinal Calculus.

Moisture	44·10
Loss on ignition	9·12
Insoluble in hydrochloric acid	0·47
Lime	0·22
Magnesia	16·12
Potash	0·17
Phosphoric acid	28·87
Undetermined	0·93
	100·00
Ammoniacal nitrogen	5·32
Total nitrogen	5·64

The calculus probably consists of crystallised ammonium magnesium phosphate $(NH_4)_2\ Mg_2\ P_2O_8\ 12\ H_2O$ ...	98·74
Tricalcic phosphate $Ca_3P_2O_8$	0·48
Insoluble	0·47
Undetermined	0·31
	100·00

Uric acid and urates were absent.

Although this salt is a very common constituent of such calculi, it is unusual for a calculus to consist wholly of this or any individual salt. They are usually mixtures of the nature indicated above, the ammonium magnesium phosphate being commonly associated with phosphate or carbonate of lime. These salts are frequently arranged in concentric layers.

Burnt Sheep Manure.

Messrs. H. E. A. and V. White, of Belltrees, Scone, in submitting a sample of burnt sheep manure for report as to its manurial value, state: "We, of course, know that the substance is more valuable in its natural state, but in this case we are unable to use it so, for the reason that it is taken from the earth floor of a large weather-shed, where it cakes into an extremely hard state and can be reduced by fire only. When removed from the floor the manure is in the form of slabs, some 3 inches in thickness, and is quite impervious to the weather."

The Chemist, Mr. F. B. Guthrie, reports: "This burnt manure contains:—

		per cent.
Ash—Insoluble	75·10	94·23
Soluble	19·13	
Volatile matter		5·63
Moisture		·14
		100·00

"Analysis of crude ash:—

Insoluble matter...	75·10
Iron and alumina	2·38
Lime	6·40
Magnesia...	1·13
Potash	7·94
Soda	2·84
Chlorine	3·02
Sulphuric acid	1·15
Phosphoric acid	·83
Minus oxygen	·68"

This is quite a valuable manure on account of the potash, which makes it worth about £2 per ton. It is not a complete manure, as it contains no nitrogen and very little phosphates, but its content of lime and potash render it applicable in all cases where wood ashes are used, although it is superior to wood ashes in fertilising power.

On the same basis unburnt sheep manure is worth 14s. 6d. per ton, but it takes 1 ton of unburnt manure to produce $1\frac{1}{4}$ cwt. of burnt manure.

The Nyngan Experiment Farm Soils.

As cropping operations will shortly be undertaken at the newly-established Experiment Farm at Nyngan, samples of typical soils from various portions of the area have been submitted to the Chemist for analysis.

Samples were selected from six different places, and concerning them Mr. F. B. Guthrie reports:—

No. 1 sample, consisting of surface loam (5 inches) of brown colour. The true subsoil is overlaid by 9 inches of sub-surface soil.

In this loam there are no stones, and under 2 per cent. of gravel, with just a trace of root fibres. More than half the loam (59·71 per cent.) consists of clay, and the balance (28·66 per cent.) of sand.

It contains a fair proportion of nitrogen, sufficient lime for ordinary cropping, a good supply of potash and of phosphoric acid. The special defect of this soil is its low capacity for absorbing and retaining moisture; and this is due to the small proportion (4·28 per cent.) of humus or vegetable matter.

No. 2 sample is from a "scalded" patch, and consists of stiff clay ranging from 1 to 8 inches in depth. In this brown-coloured soil there are no root fibres, no stones, and just a trace (0·17 per cent.) of fine gravel. Of the bulk, 13 per cent. is sand, and the balance (86·83 per cent.) is clay.

It contains a fair amount of nitrogen, a satisfactory proportion of lime, and sufficient potash and phosphoric acid for a wheat crop, but is highly charged with common salt, and will, in the opinion of the Chemist, require draining to get satisfactory results.

No. 3 sample consists of a light loam 9 inches in depth from Block 68. It is of reddish colour. It contains no root fibres, stones, or coarse gravel. Of fine gravel there is nearly 9 per cent., and of clay just under 30 per cent., the balance (51·66 per cent.) being of sand.

It contains a satisfactory percentage of mineral plant-food for immediate cropping, and a fair amount of nitrogen Its capacity for water is low, but its capillary power is excellent.

The main defect is lack of humus and consequent incapacity to retain moisture. In its present state it gets as dry and hot as pepper.

No. 4 sample is another clay from 1 to 9 inches in depth, which holds moisture well, but cannot be worked when dry. It is of reddish-brown colour, and comprises 90 per cent. of clay, with 8·33 per cent. of sand, and an insignificant proportion of gravel, without any stones or root fibres.

So far as fertility is concerned, there is a satisfactory percentage of mineral plant-foods—lime, potash, and phosphoric acid, and a fair amount of nitrogen. The capacity for water is good, but the incorporation of humus is necessary to render the soil sufficiently retentive of moisture and kindly to work. As in the case of the sample No. 2 from the "scalded" patch, the Chemist found common salt present in this soil.

The next sample (No. 5) is from Block 69, consisting of black soil plain, and is a dark grey substance consisting of 92·34 per cent. clay, with 6·66 per cent. of sand, and a very small quantity of gravel. So far as plant-food is concerned this soil is very satisfactory. Its capillary power is very good, its capacity for water is good, and it retains moisture fairly well. It may be greatly improved in all respects by the addition of organic matter to form humus, which would also improve the texture.

The last sample (No. 6) is typical of the largest area of the Farm. It is a reddish-coloured loam with 60 per cent. of sand in it. Of clay there is 34·80 per cent. and 4·7 per cent. of fine gravel. It is entirely devoid of coarse gravel, stones, or root fibres, and there is just the merest trace of organic matter. The result is that it is a fearfully dry soil, deficient in

nitrogen, and requiring the incorporation of a large proportion of vegetable matter to make it productive of satisfactory crops. The proportion of lime and of phosphoric acid is fair, but there is a deficiency of potash.

Speaking generally, these soils, which are each typical of a vast area in the Western District, are capable of carrying wheat crops for a year or two without manuring, but they will all be apt to dry out very rapidly until economical means can be adopted of repairing the deficiency in organic matter. This will naturally be one of the principal aims of the Farm Manager.

The cause of "scalded plains" has long been a doubtful question throughout the back country, and in order to determine the extent to which the salt present may contribute to the apparently permanent sterility of these patches, the Under Secretary has arranged with Dr. Tidswell for samples specially taken to be examined bacteriologically.

Manuring of Vineyards.

The attention of the Minister of Agriculture has been drawn to some remarks which were recently published in regard to manuring experiments carried out by Mr. G. Frere, of St. Hilaire Vineyard, near Albury, and he desires to point out that it was owing to the action of the Department of Agriculture that these experiments were first initiated by Mr. Frere.

In April, 1898, the Viticultural Expert, Mr. Blunno, delivered a lecture to the Albury and Corowa Vinegrowers' Association on the subject of fertilisers (afterwards published in the *Agricultural Gazette* for June, 1898). Following on this lecture, Mr. L. Frere and several other vignerons in the Riverina district expressed their willingness to carry out certain experiments with fertilisers and green manures under the guidance of the Department. The latter supplied the seeds and fertilisers required, and Mr. Blunno gave minute instructions for the proper carrying out of the experiments, and personally superintended the trials.

These initial experiments gave very encouraging results. It was proved that some manures tried were not suitable for that district, while the use of others gave excellent results, more than twice the ordinary crops being realised in some instances.

The experiments were continued in the following year with further success, when it was considered that the experiments had been fully proved. Mr. Frere evidently realised the importance of continuing the system of manuring advocated by the Viticultural Expert, and the Minister is most gratified to learn that the results achieved by Mr. Frere in adopting the Department's methods have been so successful.

The Butter Industry during Season 1908-1909.*

M. A. O'CALLAGHAN.

THE best guide to the condition of New South Wales dairying industry is undoubtedly obtained through a review of our export butter business, and when it is stated that we have more than maintained our trade of last year, despite a severe drought on the South Coast, it will be understood that the industry is still a growing one. In fact, New South Wales is the only State of the Commonwealth that shows an increased export on the previous season.

During the year ended 30th June, 1908, it was estimated that we exported 15,042,206 lb. of butter to places outside the Commonwealth, while for the year ended 30th June, 1909, it was estimated we sent 15,827,000 lb. of butter to places outside Australia, and our inter-state exports for eleven months ending May 31st, 1909, reached the large total of 5,967,784 lb.; and judging by these figures, which have been kindly given me by the Collector of Customs, I estimate that we will have exported to all places outside New South Wales over 22,000,000 lb., as against 21,422,535 lb for the previous season.

A notable feature in our export trade is the development in the East, we having exported to the East 799,315 lb. The bulk of this trade goes to Manila, and as that is now a United States colony, all butter sent there must be guaranteed free from preservatives other than common salt. Our trade with the western portion of Canada has also shown a healthy condition, we having sent there last year 29,436 lb.

Evidently it is cheaper for the Canadians on the Pacific slope to get their requirements over local production from Australia rather than from eastern Canada or the United States; this trade, however, can scarcely be depended on to reach anything like a large business, because it is only when our prices are low compared with American rates that we can hope to get the trade.

One thing about the Canadian trade is that they must have good quality; and, as will have been seen from correspondence which has recently appeared in the Sydney press, they prefer butter which carries with it a Government certificate of quality.

Quality.

Inspectors under the Commerce Act examined 16,184,896 lb. of butter intended for export during the eleven months under review, and from these examinations we can obtain a very good index of the quality of our principal dairy product.

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* Read at the Conference of Dairy Factory Managers, Sydney, 21st June, 1909.

The records show that of this total—

14·09	per cent. was up to	Superfine	standard.
44·61	,, ,,	First Grade	,,
40·00	,, ,,	Second ,,	,,
and 1·30	,, ,,	Third ,,	,,

Making the usual allowances for difference in value between first, second, and third grades, it is estimated that we would have obtained £30,246 more for our export butter if all had come up to the average standard of first grade. These are figures that factory managers and farmers must consider seriously, and see what can be done towards reducing the percentage of butter below first class which is manufactured.

Improvement.

Poor as these figures look, they, however, show a distinct improvement on the previous season's quality when the percentage of butter falling below first quality was estimated at 54 per cent. Progress has been made, but nothing like what can be done if *strict cream grading and payment for same according to its quality be made universal.*

Every factory manager knows that too much leniency is shown to the careless farmer, and that instead of erring on the severe side, the average cream grader allows all the cream he possibly can to pass into first grade. This would soon cure itself if the grading of all butter was the rule. Then the cream grader would be on his mettle, and he would take good care that no doubtful cream was allowed to pass into the first quality vats. Here again, however, the cream grader's work will be rendered partly useless as an educational factor, unless the directors back up his work by paying only second quality price for second quality cream.

Check Cream-Graders.

The representatives of the Richmond River factories at their recent conference gave a good advertisement to the policy of the Dairy Branch of the Department of Agriculture by their decision and recommendation to the proposed combination of factories to appoint special cream graders to check the work done by the individual factory graders. This was one of the cardinal points of the Dairy Bill introduced into Parliament in 1903, which Bill, by the way, met with considerable opposition by North Coast factories at the time. It was intended under that Bill, if it had become law, to have official check cream-graders in the principal dairy districts, and these graders would also act as general dairy instructors with powers of inspection, so that in cases of obstinate and careless dairy-farmers they would have the power to recommend that their licenses be cancelled if their premises were allowed to become unclean. This is where the official check cream-grader would have a big advantage over the ordinary combined factory representative.

Supposing that the factory grader does his duty strictly, his actions will be sure to cause a great deal of the cream rejected by him as inferior to be sent to outside factories, where his power does not avail. Thus proprietary

factories will have grist sent to their mill by the representative of the co-operative institutions. How different the case of an official grader acting under an Act of Parliament. He would have entrance to all factories, proprietary or co-operative, would check the grading in each place, send through the managers to the farmers a docket showing the grades of their cream, and if Bill Jones left one factory and went to another, he would meet the same official grader, and as a consequence he would be compelled by force of commercial reasons to improve his methods, and would then send his cream to the nearest factory, all other things being equal.

Butter Grading.

Now what is the official butter grader, if not a check cream-grader? If the cream-grader does inferior work, is not it as surely represented in the resulting butter as night follows day? How then can any man claim to be consistent who advocates check cream-grading and opposes butter grading? Of course, in large concerns the general manager should be the chief check cream-grader, and should thus be his own butter grader. To have his grading officially checked when the butter is a few days older is only a help that he should be glad to take advantage of.

The Art of Cream Grading.

It is easy to talk of strict cream grading and check cream-grading, but how many people realise how really difficult it is to grade creams of all ages correctly according to their qualities. Tea tasting takes some time to master, but how much more difficult is it with a substance like cream that is continually undergoing a mixed and varying fermentation.

A good palate and nose can do wonders, but how many people possess that necessary keen sense of smell and taste, and then again how weak indeed is this system of examination when faced with cream, from a dirty dairy, only two or three hours old.

Bacteriology.

Bacteriology has taught the dairy worker that the bad taints which old creams possess are due to the actions of germ life, and in cases of doubt the trained factory manager or cream grader of the future will have recourse to the aids of bacteriological science in the check grading of his cream. No matter how fresh the cream is, if it is to become inferior later on by fermentation the germ is already there, and the placing of a trace of this cream into a suitable growing medium will show whether the cream contains any germs which will affect the quality of the butter later on.

Germ Poisons.

At present dairymen are allowed to use preservatives (boric acid and borax) with which to destroy or check the growth of germ life in butter, but just as these preservatives have been prohibited in milk and cream, so they will in time be not allowed in butter, and when that day comes there will be no room for the factory manager who keeps his eyes shut to the educational advantages

which an advanced world provides, and those dairy countries where such education is not provided will have either to import managers or drop out of the great race being now run by such countries as Denmark, Ireland, Sweden, Australia, Holland, New Zealand, Siberia, the Argentina, &c., for a fair share of the prize known as the English import butter trade.

The amount of Preservative which is retained in Butter.

Experiments carried out during the year go to show that the boron preservatives now used are so easily soluble in the butter moisture that little more than half the amount usually added is retained in the finished product. The following table illustrates the point:—

Mark on butter.	Amount of preservative added, per cent.	Amount of preservative in finished product, per cent.	Percentage lost.	Percentage of water in finished butter.
	lb.	lb.		
A	0·25	0·13	48	12·73
B	0·50	0·26	48	12·06
C	0·25	0·13	48	11·06
D	0·50	0·21	58	11·13
E	0·25	0·17	32	15·37
F	0·50	0·36	28	15 76
G	0·50	0·29	42	12·28
H	0·25	0·15	40	14·08

Three per cent. of ordinary dairy salt was added in the manufacture of all the butters, save those marked "E" and "F," and these were unsalted.

It is seen that the percentage of preservative lost in the process of working the butter was considerably less in the case of the unsalted butters, due, no doubt, in chief to the fact that these butters were not worked as dry as the salted butters, which, as all factory managers know, is commonly the case. Unsalted butter with 15 per cent. of water will look as dry as a salted butter with only 12 per cent. of water.

The addition of salt to butter facilitates the removal of unnecessary moisture. Add salt to fresh meat, and allow it to stand for a time. You will then observe that the meat is weeping as it were, due to the action of the salt. Similarly with butter, the water dissolves the salt, and the brine thus formed is very easily expressed from a firm butter.

Now as to the preservative action of a mixture of boric acid and borax:—

The butters as manufactured with and without the addition of a boron preservative, stored for five or six weeks, and then examined, have shown clearly that it is only by the aid of these preservatives we are enabled to manufacture a butter from an average first quality cream which will retain its flavour sufficiently long for us to market it in England in fair condition.

It might be asked how is it that such a small amount of a mixture of boric acid and borax has such a strong preserving action. My work on condensed milk some years ago showed me that the inhibitive action of boric acid on

germ life differed greatly according to the amount of water in the substance to be preserved. A quarter of one per cent. of boric acid in pasteurised milk of ordinary density had only a very weak preservative action indeed, but the same amount added to unsweetened condensed milk had very great inhibitive powers. The chief reason for this lies in the fact that one contains so very much more moisture than the other.

Now if we find ·37 per cent. of boric acid in a butter which contains, say, 12 per cent. of water, and we assume the preservative is dissolved in this water, the butter particles are really surrounded with liquid which contains slightly over 3 per cent. of the preservative in question, and we know from experience that a 3 per cent. solution of boric acid has considerable antiseptic properties. Hence the advantage of even small percentages of boron preservatives in butter.

Details of experiments are given in the following tables :—

Effect of Boron Preservatives on the Keeping Quality of Butter.

SOME EXPERIMENTS.

Berry Experiments—August 28, 1908.

No.	After 1 week in Cold Store : First Judging.	Judging 5 weeks later.	Judging 8 weeks later.	Amount of Preservative in Finished Butter.	Salt Added.
	Points awarded for flavour out of 50.				Per cent.
1	42	37	....	·00	3
2	43½	38½	....	·13	3
3	43	40	....	·26	3
	Berry Experiment No. 2—October 20, 1908.				
	Judging 2 days after.	4 weeks later.	8 weeks after.		
	Points awarded for flavour out of 50.				
4	43	40	34	·00	3
5	44	43	39	·21	3
6	44	42	37	·13	3
	Mittagong Experiment—December 18, 1908.				
	1st Judging 4 days after Manufacture.	5 weeks later.	....		
	Points awarded for flavour out of 50.				
1	44	40½	....	·29	3
2	43	40½	....	·15	3
3	42	36	....	·00	3
4	40	36	....	·00	Nil.
5	43½	41	....	·36	,,
6	42½	38	....	·17	,,

Heated Butter.

Place some butter in a glass and put the glass into warm water. Let the butter thus become liquefied, and let it be cooled as soon as possible. Examine it next day, and we find that we have an article not recognisable in taste or smell as butter. The butter-fat has assumed the taste of tallow. If factory managers would only carry out the little experiment here described, they would never send butter out under conditions which will cause it to melt even partially; and if railway authorities and steam shipping managers were compelled to eat some of the butter that becomes melted by their neglect to provide adequate cooling provisions, we should be able to place New South Wales butter of a better quality on the local and British markets.

Butter Transit Arrangements.

The dairying industry demands better transit arrangements than are available in New South Wales to-day. Every bar-bound boat brings to Sydney a butter that has been rendered inferior by the high temperature prevailing in the ship's chambers on those occasions compared with the temperature of an up-to-date cold room. In addition, there are some boats bringing butters to Sydney regularly (or irregularly) from the smaller of the northern rivers that have no cold chambers. Such districts lose a lot of money annually through this deficiency. Likewise every week in summer sees heated butters arriving by train. The Russians, with their educationally unadvanced condition, know enough to place specially-refrigerated butter-waggons—well cooled and well cleaned—on the railway from Siberia to their ports on the Baltic; yet New South Wales, with its advanced educational methods and up-to-date ideas, does not make anything like as good a provision for the preservation of the good quality of our butters.

Butter is carted through the streets in ordinary waggons from and to our ships. The Russians have their railways laid on to the wharves, and the butter does not suffer from a heated passage through the streets. Every steamship company should have a cold store at their embarking port, such as at Tathra, Ballina, &c., so that when a boat becomes bar-bound or delayed through rough weather the butter may be held in cold store at a suitable temperature. Look what it would mean to the Bega district factories if there were a good cold store at Tathra.

Fishy Butter.

This season we have not heard officially of many complaints of fishiness in New South Wales butters. We cannot say whether this is due to butters of this character being sold locally, or whether there is a general decrease in this trouble in the State. I would like to point out, however, that with more frequent deliveries of cream the complaints *re* fishiness should decrease, because the germs that cause fishiness will grow so rapidly in cream that more of the substance causing the fishy odour will be elaborated in two days in cream than in two weeks in butter. Always remember, one can of stale cream that has a fishy flavour will, by adding myriads of the germs,

contaminate a vat of 1,000 gallons in a few hours. Clean dairies, regular cream deliveries, proper cream-cooling rooms in the factories, and efficient cold storage, would soon put an end to fishiness in our butters.

Butter Grading during the Season just ended.

A report published in the *Sydney Morning Herald* of June 15, giving a review of the butter trade from the English point of view for the season, dealt with the question of butter grading in each of the Australian States, and whereas the compulsory grading system adopted in Queensland was stated to have produced the best results, still the work done by the New South Wales graders on the basis on which they are working was highly spoken of, whereas fault was found with the work of the Victorian graders.

I do not know the causes of the complaints regarding the Victorian article, but from a conversation I have had with a gentleman who has recently come from London, and who was in a position to give an opinion, it appears the chief cause of the trouble was what was deemed by the London merchant to be an excessive amount of water in the average Victorian butter.

The material fact, however, is that two States of Australia mainly concerned in the export of butter have conclusively demonstrated during the season that if a butter is carefully graded on this side it will be practically similar in quality on arrival in London, provided, of course, that the freezing companies and the steamship companies have done their duty.

This being so, it would appear unnecessary to labour the point further than to add that those who oppose butter grading in the future must have some other weapon with which to fight their battles than that of incapacity to grade butter here which will turn out true to quality in London.

If further proof were wanted, no better example could be given, perhaps, than that of such factories as Byron Bay, Kyogle, &c. It is very rare that the superfine grade brands of these factories turn out of a lower quality, showing that where the manager does his grading carefully the official grader has an easy duty to peform.

It is an extraordinary thing to find a man claiming that the butter factory manager is the only person in a position to grade his butter, the argument being that he is the only person who knows what the quality of the cream was from which it was made. Factory managers as a general rule should know better than this. They all know that it is more difficult for the factory manager to grade his cream, which is probably only a few hours old on its arrival at the factory, than it is for the butter grader to classify the butter on its arrival in Sydney, say, from three to seven days after it has been manufactured. In the one case, any injurious bacteria that may have gone into the product will have had time to produce sufficient action to make their inferior influences easily recognisable, whereas in the case of the butter grader who examines the butter, say, three to seven days after it has left the churn, the bacteria that work their influences for good or ill will have had time to demonstrate their capabilities under the circumstances existing, and the grader will be able to recognise by the ordinary methods of taste and smell

why the butter has begun to decompose, or, in other words, why any substances giving forth an injurious taste or smell have been elaborated through the agency of bacterial growth.

The official grader should, under a proper system of advanced and scientific dairying, be merely a part of a co-operative machine, the factory manager being the co-partner.

Water in Butter.

I have already referred to complaints of excess water in Victorian butter, and when I speak of excess water I mean what the trade considers an excess.

The newspapers have also contained distinct grumblings regarding the percentage of water contained in New Zealand butters during the past season; but it is pleasing to be able to state that very little, if anything, has been heard from the London standpoint of excess water in New South Wales butters.

As is generally known, our inspectors under the Commerce Act, who also act as graders, as a general rule keep a very close eye indeed on the butters submitted for export, with a view to detecting any excess water, and samples of any doubtful butters are constantly submitted for analyses.

The law, both here and in England, allows a limit of 16 per cent., but if all the butter manufactured in New South Wales approximated to this limit, we would have a multitude of growls from the trade.

Before being consumed, all butter has eventually to be cut up in ½ lb., 1 lb., or 2 lb. rolls or blocks, and the grocer who generally does this cutting up has no desire to lose 2 to 4 lb. of water in every hundredweight of butter he sells, and this is what frequently occurs to him when he purchases a butter that contains anything in the neighbourhood of 16 per cent. of water, especially if the butter is a salty one, because it will then more readily part with its moisture on being cut up.

Under the circumstances, apart from any other factor, we might ask our selves is it wise, even though the law permits us, to carry on a state of things which irritates our customers? Trade is hard to gain, but easy to lose, and if the butter manufacturers of other countries supply an article which has none of these deficiencies, it goes without saying that the merchants of such countries will have preference in the way of trade.

Water versus the Law.

It was not until recently that the English Government passed regulations governing the percentage of water which should be allowed in butter. Now they have fixed a standard of 16 per cent., and a check is being kept on the imports with a view to prosecuting offending importers.

So far Australian exporters have not, as far as we know, been before the English Court for excess water; but there is no doubt whatever but for the timely intervention of the Commerce Act, a great many cases would have been filed against importers of Australian butter.

When the Commerce Act was put into force three years ago, excess water in butter was common. Now, I am pleased to say, very few cases crop up.

There have, however, been some prosecutions of Sydney merchants in the Customs Court for submitting butter for export containing more than 16 per cent. of water, and fines have been inflicted which, I have no doubt, have in due course been passed on to the manufacturers of the butter, and no doubt some factory managers have possibly heard of such fines.

There is no excuse for a butter-maker who has refrigeration to aid him turning out a butter containing 16 per cent. or more water, and now that a Pure Food Act has been passed in this State, the regulations of which will be put in force very soon, the erring factory manager will find the door closed against him when he wishes to market locally butter containing an excess amount of water, and which his agent wisely will not submit for export.

It behoves all factory managers, therefore, to work their butter with the same care during the non-export as during the export portion of the year, otherwise they might find themselves arraigned in the local courts on a charge of having submitted for sale an adulterated article. Recently 185 samples of our export butter were analysed, with the following results:—

Below 10 per cent....	1 sample.
Between 10 and 12 per cent. ...	35 samples.
,, 12 and 14 ,, ...	87 ,,
,, 14 and 16 ,, ...	55 ,,
Over 16 per cent.	7 ,,

Water and the Keeping Quality.

Managers should bear in mind what has been stated and demonstrated in the foregoing, namely, the more water the average food product contains the quicker will be the bacterial development, and also the less will be the preservative influence of a given per cent. of a substance like boric acid. Although there is, as is shown, a counteracting factor in the latter case, because butter containing the most water, as a rule, will be found to contain the highest percentage of preservative, provided, of course, that equal amounts have been added to all butters.

Another point which should be remembered is that on being defrozen the butter with a high percentage of water will go bad more rapidly than that with a low percentage. Here again, bacterial activity under fairly high temperatures is the chief factor.

I think all managers should aim at producing a butter which contains not more than 14 per cent. of water, which is the limit under the Commerce Act for butter of superfine quality.

Another point in connection with this water question is, that it will be very difficult for a manager, who is working on irregular water contents, to say how much preservative he can safely add to his butter. If he allows 16 per cent. of water in his butter one week, and only 12 the next, and says he adds $\frac{3}{4}$ per cent. of preservative in the first instance, he may find that he has exceeded, in the case of the 16 per cent. butter, the standard which the laws allows for boron preservatives.

Streaky and Mottled Butter.

Whereas the general manufacture of graded butter at least has considerably improved during the last two years, every now and then a factory lost its chance of obtaining the highest grade through having mottles or streaks appearing in what otherwise looked a perfectly manufactured article.

I would like managers to bear in mind the fact that English examiners are more severe on mottled or streaky butter than is the average butter judge in Australia, and hence everything possible should be done to avoid such defects.

Streaks, as is known, are the result of an incomplete mixing of the salt with the butter, whereas true mottles are due to the presence of casein or curdy matter, while a pseudo mottle may be caused through a very sudden chilling of freshly salted butter even though the butter may have been worked twice.

Of course it is impossible for managers, who allow very overripe cream to get into their first grade cream vats, to make a butter which will not show mottles, because all cream which becomes very overripe contains a certain amount of casein which cannot afterwards be separated from the butter, and hence we get mottles.

Many managers also have the habit of working a good deal of water out of the butter before adding the salt, and then there is not enough moisture left to readily dissolve the salt, and as a consequence, to the surprise of the manager, his butter turns out streaky. The salt should be added to the butter immediately the latter is placed upon the worker, when it will be easily dissolved, though it would be well to make an allowance and add a little more salt for the extra amount that will be expressed from the butter in the shape of brine.

Amalgamation of Richmond River Factories and Brands.

A movement has been, as you are all aware, made to amalgamate, practically speaking, all the co-operative factories on the Richmond and Tweed Rivers, and have all the produce from these factories sold under a common brand according to quality.

Speaking on the question of dairying, about six years ago at Alstonville, I recommended the amalgamation of the co-operative factories situated in the Big Scrub of the Richmond River for selling purposes. At that time not many brands had been firmly established, and the proposition would have been much easier than at present.

I do not wish to discuss the matter from a general point of view here, but only to speak of matters which concern factory managers generally, and which might help to give them a fuller understanding of market conditions in England.

From time immemorial the English butter trade appears to have been worked with a multiplicity of brands. The reason for this may not be evident to the uninitiated, but if we consider the selling system in vogue there, we will see the necessity of the policy.

Take a large wholesale house whose travellers go all over Great Britain representing not only butter, but such other food products as bacon, cheese, tea, &c. All these houses work their business on lines differing in detail. One house may make butter its main line, whereas another may sell its butter without profit for the purpose of inducing retailers to purchase their tea or their bacon, depending on the latter lines to bring them in their profit.

If a traveller wants to get portion of a butter trade of a grocer, wholesale or retail, there is no use in offering him the same brand of butter as his competitor offers, unless he does so at a lower figure, because the English trader is very conservative, and he will not change his custom merely to gratify the traveller. If that traveller, however, by his persuasive influence can get the grocer to take a sample of his special brand of butter, and that either the grocer or some of his principal customers prefer the new brand, he has established a connection which may be a growing one, whereas if he could offer only the same brand as his competitor, he could not possibly have established that connection for his house (which in the end might not mean only butter, but bacon, tea, cheese, &c.) without accepting a lower price, thereby reducing not only the price of the butter of that brand which he sells himself, but all the butter sold under that brand during that week by competitive houses. It is a notorious fact that you cannot sell the same brand of butter to different grocers without its becoming well known to those concerned. The traveller of your competitor who follows in your wake finds out what price you are charging, and his business ability comes in in letting one grocer know that he is being charged more by one of his competitors for any article than has another grocer in the next street or in the next town.

Every house then wants its own special brands in order to give their travellers scope, and to come down to the narrow facts, the house, for instance, that has been advertising and selling Kyogle butter, Alstonville butter, &c., during the past five or six years, would have to go elsewhere for an article to replace these butters.

An alteration of the brand would mean a great amount of persuasive power on the part of the traveller to get the grocers to see that it was the same article as that he had been supplied with the previous season, and which had given satisfaction to their customers.

On the other hand, the fact of being able to place a large quantity of butter under one brand has undoubted advantages; but this works mainly with very large houses who buy in very large quantities, but generally at a somewhat

lower price than is paid by the average wholesale grocer. If, however, all the Big Scrub district were represented by one brand, the owners could demand a good price, because the same flavoured butter would not be obtainable outside that brand.

Another point which must be borne in mind whenever any proposition is being put forth to bring the produce of different factories under a common brand is, that all the butter packed under a common brand should have, as far as possible, a common flavour. The method of manufacture and turn-out of the package can always be brought to a common standard; but this is absolutely impossible in the case of flavour which depends so much on the food which the cattle consume and on the character of the lands on which the animals are grazing. It will be, for instance, impossible to ever produce a butter of exactly the same flavour from the big scrub lands of the Richmond River with their chocolate soil, and from the rich alluvial black soil flats on the river banks, or from the sweet varied pastures on the hills round Kyogle. The reason of this is evident to all who know anything of dairying, and the common sense of not placing butters of varying flavours under a common brand must also be evident.

For instance, it would never do to give a man twenty boxes of butter of the same brand, ten boxes of which may have an entirely different flavour to the other ten.

I tried this once with two factories situated only 5 miles apart and under the same general management, but the pastures of the one were of a sweet hilly nature, whereas in the other the bulk of the milk was drawn from low-lying rich lands.

Both butters were first quality, but the flavours were different, and when a big demand set in for the brand of butters from one of the factories I suggested that they should try the butter from the other factory and had it put up under the same brand. The result was failure. Customers recognised that the butters were not the same, and it is peculiar how readily a customer thinks he is being had if you give him anything different from what he had received before under the same brand that he was satisfied with. You may give him a better article even but you will not satisfy him. Such is human nature.

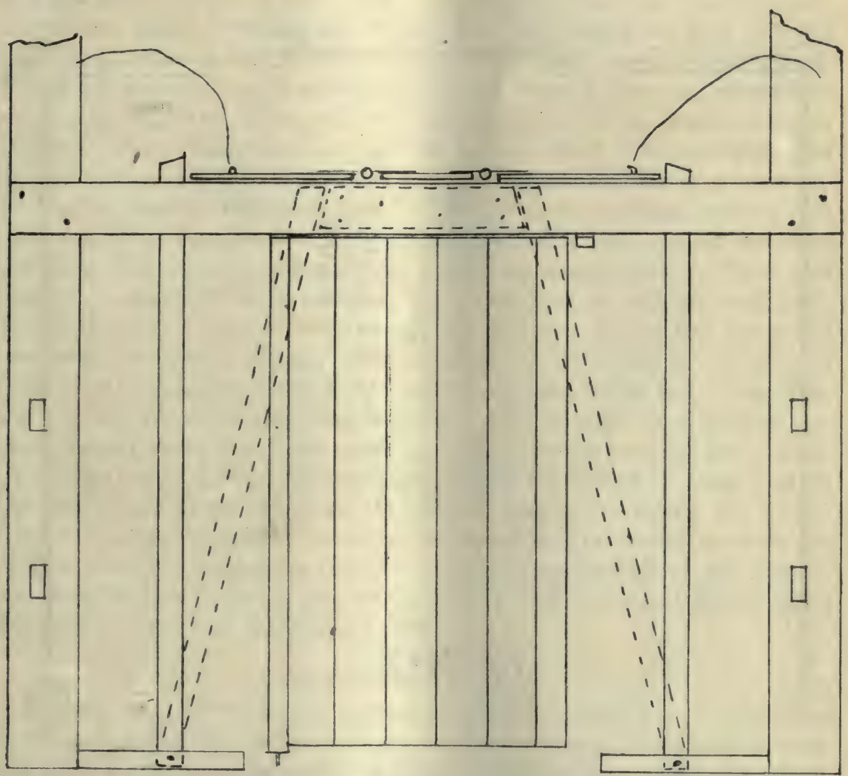
Hence, though the factories in the big scrub of the Richmond River may be all united, and with careful selection of cream a common brand could be used for a great proportion of the butter; still, those factories that are on an entirely different country should not be included under a common brand, though, of course there is no reason why they should not be included if they see fit in any amalgamation proposals which do not affect their identity in the way of sinking their brands or pooling their butters.

I might conclude by congratulating the factory managers on the improvement which New South Wales butter has shown during the past year, and hope that such improvement will be continuous.

Cow-bails for Milking Machines.

As the use of milking machines is extending, and inquiries are frequently received for advice as to the most satisfactory arrangement of the bails where machines are availed of, the Dairy Expert has obtained from a member of his staff, Mr. C. Pedersen, the following details of a simple plan for two bails with room for the machine to stand between the two cows.

Fig. 1 shows the front of bails with, in centre, the door, which is hung on the outside, so as to allow the bails to drop back, as shown in dotted lines. A stop is fitted, as marked in dotted lines, between the bail head for the bails to fall on.



N° 1

Fig. 2 shows how the door is placed. It should be stayed from the outer post to the bail head. The door may be hung by making the 3 inch x 3 inch post, on which the door proper is made, round at both ends; and for the lower end a block should be set in the ground with a recess made for round end, while a hole can be made in the cross-stay for the top end, or an iron

point driven into each end to revolve on. The door swings outwards, and can be opened by a cord on rollers with a weight, but the weight should not be greater than required to pull the door open. The latch is also seen holding the door shut.

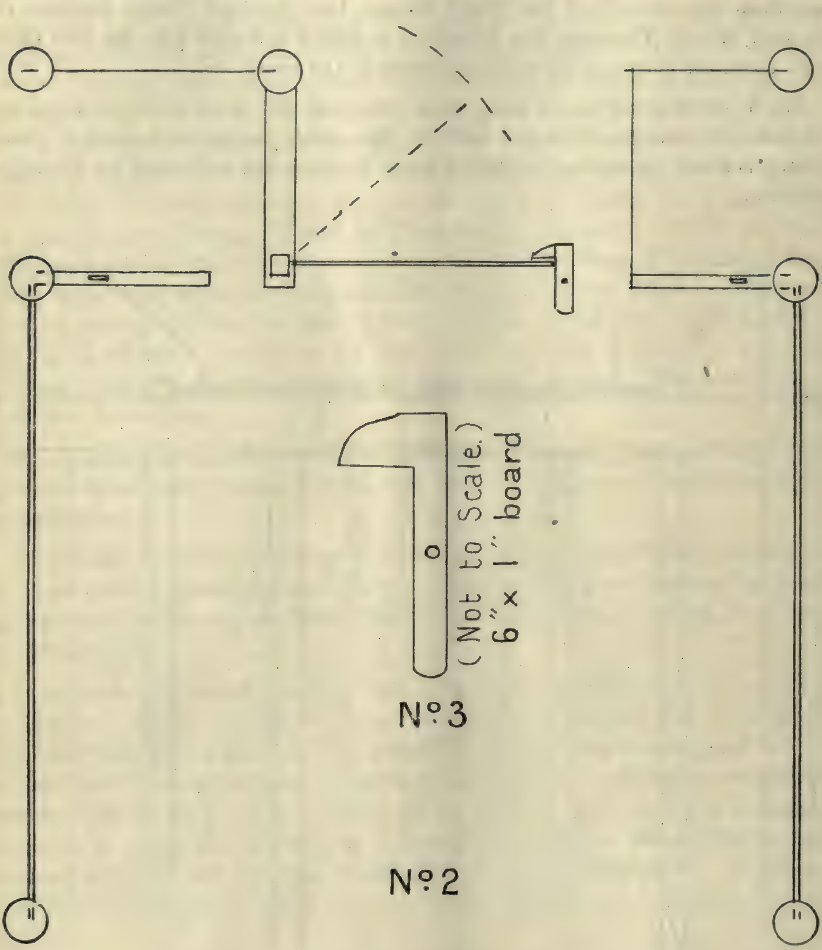


Fig. 3 shows the latch, which can be made of a 6 inch x 1 inch board, and fitted by a coach screw to the bail head.

The lock bars for holding the bails in position are 6 inch x 1 inch boards on hinges; the cord for lifting these to run back to the back end of each bail.

Ploughs: Their Setting and Special Features.

THE machines now used on the farm include some with many very intricate parts, and they perform their work satisfactorily, although some are not more than a generation old. This is satisfactory. But then there is the simple plough, old almost as sin, yet one does not always see good ploughing, or the plough set so that it can do the best work. It seems as though our engineers can contrive to make machines to do intricate work with ease to the operator, who has little more to do than press a lever, and the machine does the rest; but when a plough is turned out the operator has to apply his skill to make it go well. The maker, however, provides reasonable means of adjusting. The fact is, a plough requires more skill to set properly than the uninitiated might suppose. The setting that will suit one soil will not necessarily suit another. Who is there that has ploughed on land which is very variable who has not had the experience that at one end of the field there is a tendency for the big wheel to run away from the land side, while at the other it will cut too hard on the land side; or, again, where it will pull in much deeper in one place than another, although the surface is equally hard? When this occurs it is most difficult to set the plough just right to suit all conditions. Where the land is normal from end to end and the soil in fair ploughing condition, a well-made plough, well set, *should go from end to end without being touched by hand.* That is the best test that can be applied. Too often one sees the ploughman fail to make the mind triumph over matter, for, instead of adjusting the plough properly, he may be seen with one foot, (sometimes two) out of the furrow, struggling to keep the plough in place, leaning the greater part of his weight on the handles, and so increasing the under-friction that the draught is excessively increased, and the horses can only get along in snatches, suggesting that first the horses have a pull at the plough, and then the plough has a pull at the horses, both man and horses being thoroughly done up at shutting-out time.

The Science of Grip.

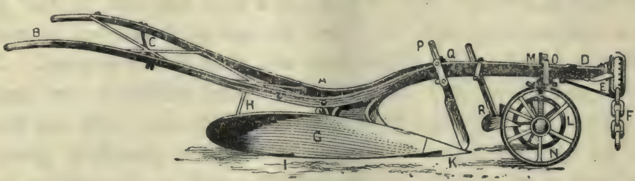
There is nothing which adds so much to draught as the weight which the holder puts on to the handles. A man may hold a plough firmly and yet add but little to the draught, and a well-set plough requires this rather than pressure. A plough that a skilled ploughman cannot set to run easily on fair land should be broken up, as it is a very expensive implement to keep. But if one looks over a plough that is difficult to hold, it is odds in favour of the fact that there is one or another of the nuts that regulate some adjustment that has never been moved since it came from the works, as can be proved by the fact that the paint has not been disturbed, while perhaps it is so long since others were moved that they are rusted in.

A plough should be easily adjusted, and this is not convenient unless all nuts and screws are kept well greased. It is as much or even more than some

will do to keep the hubs of the wheels greased, and as the ploughboy whistles o'er the lea so do the wheels. If the wheels are not kept greased they soon wear loose, and then not only will the furrow be uneven in width, but as they loll one way or the other so will the plough follow the direction, just as a bicycle does, and the man will have to hold against this tendency to run out of the straight; the lolling of the wheel also alters the depth of the ploughing, for it is not the same height when lolling as upright. The necessity for thin washers or cotters to use as soon as there is play should not be overlooked. Nothing better teaches a young ploughman the purpose of the parts than being made to take a plough to pieces, and to take out every bolt, and then put it together again. It is not time wasted in the long run, though because a plough looks so simple few are called upon to do it. For the best effect to be obtained he should be told the purport of each part.

Part Adjustment.

The main parts which are employed to adjust an ordinary mouldboard plough are the wheels, the T-head, the sliding head, the draught chain, the share, the coulter, skim coulter, breast stay, and the handles. Beyond these, however, are the less recognised points, where, through some temporary or constructional deficiency, some little ingenuity is required to make the plough run easily. The wheels mainly control the width and depth of the furrow, yet on swing ploughs these are absent, thus showing they are not indispensable



The Common Plough.

A, Beam: B, Handle or stilts; C, Handle Stay or brace; D, T-head; E, Sliding Head; F, Draught Chain; G, Breast or mould-board; H, Breast-stay; I, Mould-board Rest; K, Share; L, Land-wheel; M, Land-wheel Standard; N, Furrow-wheel; O, Furrow-wheel Standard; P, Coulter; Q, Coulter-clip; R, Skim Coulter.

where ploughs are, however, most commonly used, and on the whole advisedly so; but there is no doubt that there would be better ploughmen if everyone had to learn to hold a plough without wheels, for then he would have to give attention to points which he regards but little when using a plough mainly held in position by the wheels; just as a boy who learns to ride a horse bare-backed over a hurdle acquires a seat that will always make him sit closer and be safer balanced than one who has always depended upon stirrups. The holding of the plough itself is very much a matter of balancing, and a beginner wants to get the knack of it, both for his own sake and for the sake of the horses, for he then does with very little effort what another does less well by much greater exertion. Where the evenness of the surface permits it, the plough runs more steadily when the little wheel is set wide, but when ploughing on land with a decided and varying incline the greater width

between the wheels accentuates the effect on the furrow, for when the little wheel is on the lower side the ploughing is so much deeper than the level, while when it is on the upper side it is so much shallower. It is in cases such as these that the gallows plough, with the wheels on a fore-carriage allowing the beam free action to turn to either side, and so keep the body of the plough perpendicular, or under the independent balancing of the holder, is really a valuable implement.

Wheels Must Run Plumb True.

Where the wheels are depended upon to regulate the depth of the ploughing it is very important that they, and the standards and axle supporting them, are kept plumb true. If any part is bent it should be put right by the blacksmith, and any temporary derangement be set right by packing with a wedge to correct it. The set of the coulter also should be arranged to assist the running. Where there is a tendency for the plough to run away from its work, it should be set a trifle wide to pull it back; but if it runs in, then it should be set narrower. The coulter can greatly aid when the plough runs away from its work through the land side of the point becoming rounded and having a tendency to follow the inclination of the curve so formed. The coulter is ordinarily best set fairly well forward, but on stony ground it is desirable to set it so that a stone does not pitch between it and the share. By setting a coulter point fairly forward, by its inclination it runs freely into the softer ground below, and the cut is made up the edge, and the hard surface yields more easily so than when it is attacked more vertically. Sharp knives make easy work, blunt ones hard work; therefore the coulter, which is a knife blade, should be kept sharp. Sometimes one sees them little more than a round bar with three or four inches flattened and thick to do the cutting—which is not economical. The nice adjustment of the coulter is very essential to the easy running of the plough.

The Skim Coulter.

The skim coulter should be set to throw dung, stubble, or weeds into the furrow, and should always be provided with a sharp share, because, from its position, if it does not cut in easily, but rides on the surface, it makes the plough run very unevenly and jumpily. Considering how well the ordinary skim coulter turns its little furrow it is strange that it was not sooner adopted for bigger work, as it is made practically on the same lines as the modern digging plough. The share which cuts the under part of the furrow, as the coulter cuts the side (the other two sides not requiring cutting), requires to fit well in the socket and should be in proper alignment. Where there is structural fault which prevents the share being in proper line the plough will be difficult to hold, and if through wear there is looseness the share must be corrected by the use of thin leather wedges. When a new share is put on after one that has worn short, the ploughing will be considerably deeper, because the share is set with a downward pitch, and if the line is carried forward it would be seen that it would run below the bottom of the big wheel, therefore every half-inch worn back from the point appreciably reduces the

depth of the furrow; as most shares have rather greater inclination at the point this is accentuated. On some soils the drawing in, by pulling the wheels tighter down, will make the furrow deeper than the line of inclination indicates, especially where, as is often the case, the old share has not only been shortened, but the point has worn slightly upwards and tended to lift the plough.

Many years ago there was introduced an ingenious attachment to readily counteract the effect of a new share by making the neck into which the share socketed adjustable. This was called a lever neck, and was placed between the breast and the body.

Nicer Points of Setting.

The nicer setting of the plough is effected from the head or forepart of the beam, where there are two movable parts—one with a vertical movement, and the other with a lateral. That with the lateral is known as the head, or T-head, and that with the vertical as the hake or sliding head. In the steering of the plough it has to be remembered that it is mainly done by balancing, using the bottom of the body as a pivot. If one wants to make it run more shallow one weighs on the handles, and up comes the head. If one wants it to run to the right one shoves the handles to the left, and it pivots round, and so on. The sliding head is made with a series of notches, which allow the draught chain to be adjusted as desired. When the ground is hard there is a tendency for the share to run upwards, and though the holder can resist this to some extent by pressing the head down by holding against the tendency, he can be greatly relieved by allowing the horses to help him. This he does by altering the height of the draught point. Remembering there is a pivot on which the plough balances, it is obvious that the higher the point of attachment the more will the fore-end of the plough be dipped, while the lower the more will it be lifted out. The sliding head, therefore, affords easy correction to other faults which tend against a furrow of even depth. The draught chain, however, can be made to assist, for if short the horses will lift the head, but if long they will pull it down. Ordinarily a short chain suffices, but on hard ground a longer chain gives great relief to the holder, and the plough runs steadier; also, on very hard ground, when the horses are pulling with jerks and rolling, a longer chain makes the plough go more steadily, as more play is allowed than when every motion of the horses is imparted directly to the plough.

The T-head is a continuation of the beam, and is quadrant-shape, with pin-holes at near intervals, and is used to assist in controlling lateral swerving of the plough. The pivot action has again to be regarded, and when it is desired to pull the big wheel away from the unploughed ground the sliding head is pushed to the left, and if it is required to bite the unploughed land it is pushed to the right, being held in place by means of a pin thrust through holes corresponding in the T-head and the sliding head. The alteration of the position of the sliding head to the rigid beam is necessary also, because the line of draught is widely different when horses draw in single line, when two are abreast, or when three are abreast, as each one necessitates the

draught being more or less on one side or the other of the line of the beam, accordingly as the centre of the main whipple-tree is to the line of the beam so must the sliding head be fixed, and remembering the plough pivots, it has to be set wider in opposition to the way it is desired to turn the head of the plough.

The Run of the Plough.

The setting of the breast or mould board also influences the run of the plough, as the wider it is opened—that is, shoved out by the breast stay—so will it turn the share point on to the work. With all these means of adjusting, it looks as though the setting of a plough ought to be a very simple matter, but the struggling efforts of many ploughmen give contradiction to this. In fact, to get all these points in harmony takes a considerable period to learn; moreover, they are subject to alteration every time different work is done, and beyond all this is the knowledge which directs the best type of work to be done for the purpose ahead.

When the plough is properly set, and, of course, still more so when ill-set, there is much to do to make it run so as to give less strain to the horse and man. By the by, one ought to have mentioned that a furrow set deeper on the wing side of the share is always heavier in draught than one set with a level sole or slightly deeper on the little wheel, because the share cuts clean across when it is flat, but when the wing is lower than the preceding furrow the new furrow has to be torn out. On heavy land especially the line of fracture may continue downwards for a considerable distance, and instead of a 9-inch furrow it may break out 13 or 14 inches, bringing up very objectionable subsoil. This constitutes coarse ploughing. Coarse ploughing is not dependent upon the depth and width of the furrow, but to this breaking out of the subsoil.

When one says the plough is balanced with the centre as a pivot this must not be taken to mean that there is merely one spot which acts as pivot; it is spread over quite a big portion of the body and breast, as occasion demands, and experience alone teaches where to apply from time to time.

Turning not Easy.

The turning of a plough is by no means an easy matter to a novice; in fact, we recall from the memory of long-gone days the fact that several friends, assertive in other matters, but innocent of ploughing, beyond the universal ability to criticise everything in farming, found that there was nothing which would more quickly and unexpectedly land them in a ditch. We used to choose a rather wet headland on heavy land to accomplish this, and if they only stuck long enough to the handles the ditch inevitably received them, and they were usually far less assertive on agricultural matters subsequently. Turning is practically a matter of balancing, and one requiring some experience, to enable the plough to set in square without wriggling or stopping. The plough should always be balanced round; that is, jerked out and thrown on the breast side; then there is no ploughing or cutting up of the headland, with its inevitable mauling on wet land. In some light land districts it is common to see the plough allowed to run round on the little wheel, and there it does not so much matter; it is no easier to the holder and, except on these light soils, very prejudicial to the headland. If a plough is balanced round it is easy to throw the head into proper line, and if it falls short to turn it on to the wheel opposite to the direction it is desired to take, and let the horses pull it in.—W. J. Malden, *Agricultural Gazette*, England.

The Potato.

E. D. BUTLER.

THE potato is one of our most important food products. It is used almost as freely as bread, so that its culture and improvement deserve the greatest attention. There is no farm crop which will repay good culture as well as the potato. But growing the potato is only part of the farmer's business; he must go further, and place his potatoes on the market in a condition that they will realise top market values. Many farmers are totally indifferent as to the manner in which they prepare this product for market. On examination it is found they show a disregard to grading, and appear to make no attempt to put the tubers up in an attractive manner, while little or no attention is paid as to whether disease is present or not. The diseases most prevalent are potato scab (*Oospora scabies*) and potato moth (*Lita solanella*), and owing to their presence considerable quantites are prohibited exportation owing to restrictions in other States. This limitation of the market has a far-reaching effect. Exporters will not purchase for shipping orders, from fear of rejection, and prefer to fill their requirements with potatoes imported from elsewhere. Not only do these remarks apply to the export trade, but they apply equally to the local market; and not until such time as these defects are remedied will fair market values be realised. Many farmers, perhaps the majority, do not appear to realise the importance of grading, classifying, and bagging in attractive packages, and when asked the question invariably reply, "The good sells the bad," little thinking the very opposite is the case, as the bad reduces the standard, and, as a natural sequence, the price. Again, farmers generally appear to be totally ignorant of or indifferent to the different diseases that infect the potato, which consequently are propagated and rapidly spread year after year.

Potatoes grown in New South Wales and Potatoes Imported.

From the following table it will be seen that nearly every year more potatoes are imported from the other States and from oversea sources than are grown in New South Wales.

Year ended 31st May.	Area under Cultivation.	Total Production in New South Wales.	Average per acre.	Value.
	acres.	tons.	tons.	£
1899	27,978	61,900	2·2	269,265
1900	34,968	81,337	2·3	219,609
1901	29,408	63,253	2·1	271,987
1902	26,158	39,146	1·5	207,474
1903	19,444	30,732	1·6	192,075
1904	20,851	56,743	2·7	106,393
1905	23,855	48,754	2·0	251,940
1906	26,374	50,386	1·9	266,615
1907	36,815	114,856	3·1	548,470
1908	31,917	55,882	1·8	207,590

Importations into New South Wales.

Year.	From Other States.	From Oversea.	Total.
	tons.	tons.	tons.
1899	49,282	19,653	68,935
1900	50,409	11,978	62,387
1901	36,792	16,223	53,015
1902	56,567	8,692	65,259
1903	65,863	2,145	68,008
1904	77,375	2,287	79,662
1905	49,686	330	50,016
1906	44,671	80	44,751
1907	67,561	4	67,565
1908	81,755	2	81,757

Soil and its Preparation.

The potato has been grown throughout this State on nearly every class of land, but the ideal soil for this crop appears to be rich sandy loam, deep and friable, naturally well-drained, with an abundance of decayed or decaying vegetable matter to furnish a supply of fertilising ingredients, and to be rather moist without being wet, as the potato requires a large amount of moisture to develop a large crop. Recently-cleared land suits the potato, provided it is well drained and not too stiff, so as not to offer any resistance to the enlargement of the tubers. Very heavy clay, especially in low situations, and clay loams, should be avoided, as they are usually too cold and too stiff to permit of the proper formation of the tubers. Sandy soils, if not too subject to drought, may be fitted for this crop by the incorporation of abundance of organic matter, either by the application of stable manure or the ploughing under of cowpeas or other leguminous crops.

The soil for potatoes should be well prepared before planting. Detailed directions for the preparation of one class of soil would not apply, hence it can only be said that preparation should be deep and thorough, and unnecessary compacting of the soil should be avoided, for the potato succeeds best in soil which is loose and friable. Ploughing can scarcely be too deep, provided that much of the subsoil is not brought to the surface. Where practicable, the depth should be gradually increased from year to year.

Great care should be taken to clear the soil of couch or other tenacious creeping grasses.

It is a good plan to roughly break up the land some time before planting, so as to allow the frosts to effect their mellowing influence, as well as to destroy much of the couch and other perennial weeds.

Early Market.

Where potatoes are grown for early market, the aim is to plant as early as possible—that is, as soon as danger from frosts is over, provided there is ample supply of moisture. Nothing is gained if the crop is planted when the soil is excessively cold and wet. As early potatoes usually command good prices, it is often worth taking the risk of frost if the soil is in good

condition. Covering with litter will often ward off the effects of frosts. In order to participate in the early market, extra early varieties should be selected and sprouted before planting. Medium-sized tubers should be chosen, say about 2 to $2\frac{1}{2}$ oz. in weight, placed in single layers in shallow boxes or trays, and put in a cool, dry, well-ventilated place. When it is seen the skin is slightly toughened and greenish in colour they may be removed to a place with more light and heat. This will induce sprouting. When short, sturdy sprouts are produced the sets may be planted about 3 inches deep; the warmer the situation the better. Care must be exercised not to break off the shoots when planting, as the succeeding shoots are not so vigorous as the first. Very few varieties resent cutting, but it is best avoided in the early kidney varieties.

Fig. 1.

In this case the sprouts have developed too far, and there is risk of the long slender growth being broken off in the process of planting, which would retard the crop. The sprouts shown in Fig. 2 are just at the proper stage for planting.

On the farm where the main varieties are grown, the time of planting will, of course, vary in the different parts of the State, and the grower should be guided mainly by local conditions.

Seed Potatoes.

On the quality of the sets planted much of the success of the potato crop depends. When selecting seed the utmost care should be taken to see that the variety is true to type and perfectly free from disease. Always make it a point to obtain seed from a reputable seed merchant or some reliable grower. For main crops one or two varieties of sorts that have been tested and are known to do well in the particular district on similar soil should be selected.

In the size of the sets planted the practice of different farmers varies widely, some advocating the use of whole tubers, others claiming equally good and better results from cut sets. The danger of partial or entire failure

Fig. 2. —A good type of tuber for seed; medium size.
The lines show the most economical way to cut the sets.

resulting from an imperfect stand is much greater with small sets, cut or whole, than with large ones. The small sets are liable to perish should the season be unfavourable either through excessive moisture or drought. A number of investigators have noted that large seed pieces, either large cut sets or whole potatoes, afford an earlier crop than very small cuttings, and also produce an increased yield. Experiments carried out in the United States showed that whole tubers 2 to 3 inches in diameter yield more than small whole tubers $\frac{3}{4}$ to $1\frac{1}{4}$ inches in diameter, and large cut tubers 15 per cent. more than small cut tubers. The most economical set to use is one with two or three eyes and a good amount of flesh and weighing about 2 to 3 oz. In cutting the sets medium-sized tubers should

Fig. 3.—A good whole tuber set, about 3 oz. in weight.

be selected and cut lengthways and then across. Many growers cut the tubers into sets containing one, two, or three eyes, laying greater stress on the number of eyes than the size of the set; but it is pointed out that before the shoot develops its root system it is dependent on the material stored up in the set, hence the more abundant this supply is, the more vigorous the growth of the

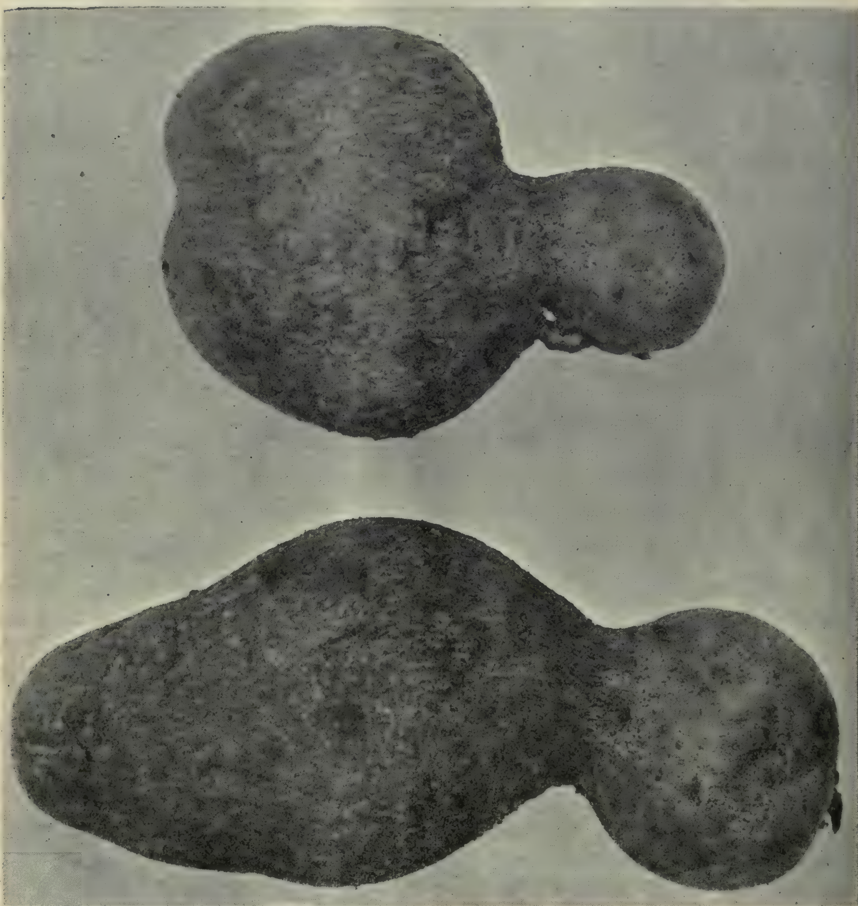


Fig. 4.—Tubers showing second growth.

Tubers such as these should not be used for seed, because they are never robust, and are a sure sign of degeneration.

plant. It is lamentable to see many farmers retaining and planting year after year the small and frequently much-diseased tubers that are unsaleable. This practice is not to be commended. A change of seed, not necessarily of variety, is of the highest importance, and should be made at least every three years. For preference, the seed should be obtained from a cooler climate. Many ideas prevail as to the relative values of different parts of the tuber

for seed. Some advocate the removal of the stem end, but experiments have shown that there is no material difference noticeable in the yield that could be attributed to the different sets, and that the two ends of the tuber are of equal value.

Varieties.

The following are among some of the best varieties to grow, but while one potato may give a heavy crop of fine quality in one place, it might be unprofitable, if not totally unsuitable, in another.

Early Varieties.—

Early Vermont.—Very early and prolific, sure cropper, and of good quality. It somewhat resembles the Early Rose, the skin is a little darker in colour, and it matures early. In the warmer districts, and in rich land, the tubers grow to a large size, and the crop is very heavy.

Early Rose.—This potato is too well known to need description; a good cropper, and early. The true strain is now difficult to obtain.

Bliss's Triumph.—A good cropper, round in shape and of a nice bright-red colour; cooks well; eyes rather deep; very early; a great favourite on the Rivers, where it is miscalled Ruby Red.

Medium Season Varieties.—

Cambridge Kidney.—A white-skinned potato; flattish oval kidney shape, of uniform size and of fine flavour. A favourite among suburban gardeners.

Bresse's Prolific.—Of good quality, keeps well. Favoured in some districts for the main crop.

Main Crop.—

Brownell's Beauty.—Without doubt our standard variety. There is probably no better known variety, and certainly no potato more largely grown than this good variety. It gives splendid results in nearly every district. It yields heavily, and can always be depended upon, and is one of the finest table potatoes in cultivation.

Imperator.—Very heavy cropper, round in shape, and white skin.

Up-to-Date.—Kidney shape, flattish, white skin, very few eyes, and heavy cropper.

Manhattan.—A dark purple-skinned potato, generally mottled, flesh white and of good quality; one of the hardiest varieties; good cropper in suitable districts, and keeps well.

Southern Star (Anderson's).—Skin pale pink, and dark eye, a heavy cropper and keeps well; good for table purposes.

Manures.

In many districts ample supplies of well-saved farmyard manure should be available, but where the soil is not in fit condition to produce heavy crops, it

will pay to use commercial fertilisers. Mr. F. B. Guthrie, Chemist to the Department of Agriculture, recommends the following as a complete manure for potatoes in average soils :—

	Quantity per half ton.	Cost. £ s. d.
Dried blood	4 cwt.	1 12 0
Superphosphate	4 cwt.	1 0 0
Sulphate of potash	2 cwt.	1 9 0
	10 cwt.	£4 1 0

Contains—

Nitrogen ... ... = 5·3 per cent.
Phosphoric acid ... = 6·8 per cent.
Potash ... ... = 10·4 per cent.

Applied at the rate of 4 cwt. per acre, this will give—

23¾ lb. nitrogen
30½ lb. phosphoric acid } per acre,
41½ lb. potash

and will cost about £1 12s. per acre.

This manure should be applied at the time of planting, and thrown on the bank so as to get mixed with the soil when the sets are covered.

Planting and Cultivation.

There is no doubt the different depths of planting will give different results, but there will not be the same results on different soils; it is therefore important to know the most economical depth to plant. About 4 or 5 inches is the correct depth to plant for good loamy soils, on account of the harrowing that is necessary to keep down weeds, and which would drag out sets if planted shallower. Sets should be planted deeper in soils likely to dry out than in others more retentive of moisture.

The usual method to plant potatoes is by hand. After the land is prepared a furrow is opened out with an ordinary plough, the sets then placed in the furrow at the required distance apart, preferably 12 to 14 inches. The furrows should be 30 inches apart, and not less than 27 inches, otherwise proper intertillage cannot be done. When placing the sets in the furrow they should be pressed gently into the soil so they will not move when being covered, which is usually done with the plough or harrow.

Soon after planting the field should be harrowed with a smoothing harrow once or twice; this is effective in keeping down weeds and levelling the ridges left in planting; it will also help to conserve moisture by preventing the formation of a crust. No matter how carefully the seed has been planted and how much the land has been manured, if the soil is permitted to become hard and weedy the yield will be much reduced. When the haulms have grown sufficient to distinguish the rows, use the cultivator to loosen the soil between them; this will assist growth and permit of the proper enlargement of the tubers. Five or six cultivations should be ample, but the grower should be guided by soil and climatic conditions. In cultivating care should be exercised not to disturb the roots. It is better to cultivate frequently and shallow. Farmers should realise that tillage is essential.

Hilling the potatoes is usually practised, but of late years growers appear to favour flat cultivation. As to which is the better system it is difficult to advise, as much is to be said for and against each method. Hilling was probably adopted in Great Britain for the purpose of affording good drainage, for in such a moist climate it is important not to have potatoes in soil that is very wet. Excessive hilling during cultivation intensifies the injurious effects of dry weather, for it is apparent the exposure of a larger surface permits of more evaporation. It also results in damaging the roots between the rows unless very carefully done. Probably in cool climates hilling would be an advantage to the crop as affording more warmth and for the development of the tubers by the loosening of the soil. There are districts where the climatic conditions are similar to that of Great Britain, and in such districts ridging will give better results than flat cultivation. In other districts where the rainfall is light and droughts likely to occur, and where conservation of moisture is a very important factor in obtaining a good crop, the best results will probably be from flat cultivation, but a thorough and deep cultivation before, and frequent tillage after planting must be adopted. It would be advisable for each farmer to test both systems on the conditions obtaining on his farm.

Harvesting.

For early market, potatoes are usually dug when they are considered large enough. Growers' ideas of readiness differ. Some dig as soon as the potatoes are as large as walnuts, but it would be wiser to postpone the operation until they are at least as large as hen's eggs, or even larger. A flattened digging fork is the best to use. Insert it about 6 or 7 inches from the plant and press it deeply to get well under the tubers.

In the case of the main crops, harvesting should not commence until all the haulms have died down and may be ploughed out with an ordinary plough, but no harm will result if they be allowed to remain in the soil a little longer, provided the land is well drained and not wet and no disease apparent. It is not a wise practice to dig in wet weather, if it can be avoided, as both the bags and potatoes become covered with soil, and unsightly when placed on the market, and if stored their wet condition is favourable to the development of disease. In warm weather they should not be exposed to the sun, and they should not be covered with the leaves and stalks, as these are sure to be moth-infested if there are any of the pests about.

Preparing for Market.

Intimately bound up with the whole matter of profitable potato raising is the demand of the market. It is not sufficient alone to grow potatoes, but it is equally necessary to send this product to market in a condition so as to be most acceptable to the buyer. In these days of keen competition buyers pick and choose to an extent not realised by one who has not witnessed the disposal of goods put on the market. This is a condition which growers should not fail to study and prepare themselves to meet, for by due attention to get-up are the highest prices to be obtained. The most essential

points are to grade, classify, and bag in clean new bags. In grading, all diseased, deformed, over-large and under-sized tubers should be rejected from first grade. This discrimination against the poor qualities of one's own products will result in making a reputation for goods bearing the brand, and will never fail to obtain top market prices.

Before bagging care should be taken to remove all soil that might be attached to the tubers, and the bags should be shaken down to ensure tight packing, but not too tight, for either too loose or too tight packing results in bruising, and decay follows. As second-hand bags are the medium of carrying many diseases that attack the potato, they should not be used unless they be clean wheat or flour bags. New bags may, perhaps, be a little more expensive in the initial cost, but they will repay the extra cost. Each grower should adopt a special brand or mark, preferably a stencil plate, and use it on his first-grade produce. If he is marketing other grades he should use another brand, and mark the bags second and third grades. Some growers may find it hard to believe that they will gain anything by thus indicating the inferiority of some of their produce, but in reality it will pay them better to get the top price for their first-grade potatoes and a fair price for the others than a poor price all round for mixed stuff.

Diseases.

The potato is subject to many diseases, and, unfortunately, they appear to be on the increase each year. Nearly all of them could be controlled, and many eradicated if the well-known preventives and remedies were applied. It is seldom a farmer will be found making any attempt in this direction. The probable reason is not that he is careless and neglects his crops as far as cultivation is concerned, but rather that he is ignorant of the cause of the trouble and is at a loss to know what to do and what remedies to apply to prevent or exterminate them, and if he does know he does not believe that the results obtained would pay for the trouble involved. There are several different diseases, caused by different germs or fungi. These are often confused, and though usually distinguished as blight, rot, scab, rust, &c., there are several kinds due to a different cause, and often requiring different treatment. An endeavour will be made to give a short account of the diseases most prevalent here and some preventive measures, chiefly those recommended by Dr. Cobb, in the hope that they will be of use to growers, for it is apparent that unless they take steps to fight these pests, lasting injury to the potato industry will be the result.

Potato Scab (*Oospora scabies*).

This is one of the most widespread diseases that infect the potato, and is known throughout the potato-growing world. The roughened, cork-like, and cankerous surface of the potato is too well known to need description. Many experienced growers believe that the scab is caused by insects in the soil, or other agencies but the right one. No doubt an injured potato is more liable or predisposed to attack, but the fungus must be in the soil. This disease is usually most troublesome in alkaline soils, but, as said before, if the germs of

Fig. 5.—Potato Scab (*Oospora scabies*).
The specimens for these illustrations were picked haphazard from the top of a sack of potatoes.

the disease are not in the soil or introduced into it by infected tubers or other means, the soil alone will not produce the disease, but if the seed is infected, perhaps only to an infinitesimal degree, conditions in the soil favourable to the propagation of the scab fungus will assist it to spread and thus manifest itself upon the crop. The same remarks apply to land heavily dressed with fresh stable manure, especially when it is placed in the furrow and comes into close contact with the tuber. *

The real cause of the potato scab was unknown up to 1890, when Dr. Thaxter, of the Connecticut Experiment Station, discovered the fungus, which he named *Oospora scabies.* Experiments have shown that scab does not develop on new land unless introduced by some outside agency. If clean seed is planted and other precautions taken a clean crop will result; if scabby seed is used a more or less scabby crop will almost surely be produced. So it follows that most of the infection on new land is the result of infected seed being planted. It is probable the scab fungus is sometimes introduced into the soil by means of tools or manure. If new land is to be broken up all implements should be thoroughly cleaned of all particles of dirt, &c. It has been said that if scab-infected tubers are fed to stock the germs will propagate after passing through the animal. Infected soil may be expected to produce a more or less scabby crop, even though clean seed is planted. Heavy moist soils appear to be more favourable to scab than those that are light and dry. It is also maintained by some that a given soil is more likely to produce a badly-scabbed crop in a wet season than in a dry one.

The treatment then resolves itself into two main problems, viz.: What measures to be adopted to decrease or eradicate the germs from infected soils; and, How can the infection of clean soils be prevented? For the former, a rotation of crops is recommended, such as oats, wheat, or other straw crops, also grasses, and an occasional ploughing under of a green crop for manure. This, of necessity, will have to be continued for four or five years, as the germs are known to live in the soil for that length of time, and even longer. For the latter, select tubers which are free from scab, but as they may contain scab germs, although perfectly smooth and clean looking, disinfect in a solution of formalin, made up as follows:—

> 8 oz. or ½ pint of commercial formalin to 15 gallons of water. Stir thoroughly and soak uncut tubers in this solution for two hours. Another effective preventive is 2 oz. of corrosive sublimate dissolved in hot water and diluted with cold water to fifteen (15) gallons. Soak uncut tubers for 1½ hours with this solution. A wooden or earthenware vessel must be used, as on account of its corrosive action metal vessels cannot be used.

Either of these may somewhat retard germination, and will injure the sprouts that have already started. Bags, baskets, and other receptacles which have previously contained scabby potatoes should not be used for clean or disinfected seed unless previously disinfected.

* The scab is generally more prevalent in soils heavily dressed with lime, or when large quantities of timber have been burned off prior to planting.

Formalin is a liquid having a sharp pungent odour, and is a solution of formaldehyde gas, the best grades containing about 40 per cent., and commercial formalin should contain at least 35 per cent.

Corrosive sublimate (per-chloride of mercury) is a white crystalline powder. It is a deadly poison if taken internally, but is safe to handle, provided the treated tubers are kept out of the way of children and stock. It is a good disinfectant, but on account of its poisonous nature it is not so preferable as formalin, which is also poisonous, but not so dangerous.

If stable manure is used, the practice of placing it in the furrows so as to come in contact with the tuber should be discontinued. It is better to manure well the preceding crop, or to put the manure in the land some time previous to planting.

Potato Moth (*Lita solanella*).

This pest is more or less in evidence in every potato-growing district throughout the State, and the loss caused by it annually is enormous. The injury produced by the worm is extremely evident to the housekeeper, as much of the infected tuber is cut to waste, and is well known to all dealers in potatoes, but very generally they do not understand the nature of the insect producing the trouble. The injury done to the plant in the field is considerable, but not so great as that to the potatoes in store.

Potatoes left in the field after the previous season's harvesting provide the main harbour, and moths bred from these are on the wing and ready to infect the growing crop. The moths usually lay their eggs in the foliage, generally at the base of a leaf; the larvæ when hatched burrows its way down the stalk, and when full grown seeks a secluded spot, generally in the wilted tops, and there pupates. If any tubers are not completely covered with soil they will be infested.

Dug potatoes left in the field, and also when stored, are liable to infestation.

The injury to the tuber is very similar to that of the plant. The eye of the potato is usually the spot selected by the moth to lay its eggs. The larvæ when hatched channels its way through just beneath the skin or through the substance of the tuber. Its presence can usually be detected by its castings or excrement which it throws out. Several larvæ have been found in the one tuber.

In suggesting remedies to control this pest, it is as well to point out that unless every grower does his part thoroughly and well no diminution need be expected; it will be of no avail for one grower to use every means to fight it if his careless and negligent neighbour does nothing but harbour the pest.

The battle should begin when cultivating. Where hilling is the practice it should be done with care, so that all tubers should be well covered with well-pulverised soil, and no clods should be permitted, as they form crevices for the moth to make its way in and do its work of destruction. Where flat cultivation is practised, plant deeply and keep the soil well stirred. When

the potatoes are dug they should be bagged without delay; if they are exposed even for a short while infestation is almost sure to follow. It will be particularly noticeable in a season when showers are frequent the percentage of infected tubers when dug is considerably smaller than in a comparatively dry one. This is mainly owing to the rain breaking down the clods and compacting the soil, effectually closing any crevices, thus preventing the moth from gaining an entrance to the tubers.

Many growers after filling the bags, and before sewing them up, usually cover the mouth of the bag with stalks and leaves, probably to shade them from the sun. This practice cannot be too strongly condemned, as the moth is generally lurking in the haulms and will immediately leave them to attack the potatoes. All stalks and foliage should be removed and effectually destroyed as soon as possible. The bags should be sewn up immediately after filling and removed without delay to suitable storage. If it is not convenient to remove them for some time they should be placed in stacks and closely covered with some cloth or tarpaulin. Extreme care and watchfulness all along the line are necessary, particularly in storage, where the majority of growers think they are immune from attack. Far from it, more damage is done while in storage than elsewhere; but if suitable storage is provided the ravages of the moth can be better controlled than in the field.

As a rule, potatoes are stacked in the open shed on the farm and no precautions taken in the way of securely covering them. To prevent infestation they should be stacked in a tight room. On top of the stack place a shallow vessel, and into this pour some bi-sulphide of carbon, and close the door tightly. This liquid becomes a gas when exposed to the air, and being heavier than air the fumes diffuse among the potatoes and destroy any moths and larvæ. This should be repeated every ten to fourteen days, in order to kill any larvæ or moths that might emerge from the egg stage. Four or five charges should be sufficient. One and a half lb. (1½) of bi-sulphide of carbon to every 1,000 cubic feet of space should be used. As the gas is *highly inflammable* the greatest care should be exercised. No lights of any kind should be near by, or disastrous results will follow.

Of course it is recognised that many growers may not perhaps be in a position to provide themselves with a suitably-closed room, but every effort should be made to do so and adopt the treatment recommended. It will be found that their potatoes, being free from infection, will realise better prices, and the trouble and expense will be warranted. In the absence of such a storeroom, the potatoes should be covered closely with a cloth. Covering with grass from some place remote from the potato crop, or hay, and occasionally sprinkling with water, is a primitive method, but is found to keep the attack in check.

The moth may also be captured by use of lantern traps. Lantern traps with a reservoir to contain water with a little kerosene floating are the best traps. The lanterns may be placed on stakes driven into the ground, about 100 feet apart. This method might be suitable on small areas, but their use would hardly be warranted on large areas.

Wet Rot.

This is a bacterial disease, and certain conditions of the soil and tuber are necessary before infection will take place. Warm wet weather is necessary, and if there are any wounds on the surface of the tuber the disease begins in patches, and the whole tuber is finally turned into a mass of brown slime, the bacteria breaking down the cell walls and the tuber collapsing. Tubers attacked by this disease decay very rapidly—apparently sound tubers in the morning are a rotten mass of pulp in the afternoon.

Wherever this disease is noticed the potatoes showing signs of infection should be burnt without delay.

Tubers with weak and spindling sprouts, and which when cut across show a ring of discoloration in the flesh about ¼ inch from the skin, should be rejected for seed, as likely to develop wet rot.

Dry Rot (*Fusarium solani vel oxysporium*).

Recently this disease has come into prominence owing to large quantities of infected potatoes arriving from Tasmania. Immediate action was taken by this Department, and the importation of infected tubers prohibited. Fortunately, up to the present, this disease has not occurred, except in a few isolated places in this State.

This disease has been thoroughly investigated by Messrs. Erwin F. Smith and Deane B. Swingle, Pathologist and Assistant Pathologist to the Department of Agriculture, Washington, United States, America, who named it *Fusarium oxysporium*. A summary of their investigations will be given:—

It is variously known as bundle blackening, stem rot, dry-end rot, and dry rot.

The bundle blackening, or dry-end rot, of the tuber are two stages of the disease. This begins in the field in the underground stems and roots. A fungus is always present in the darkened vascular bundles of the tubers in sparing amount, and cultures therefrom have shown this to be a fusarium. The above-ground symptoms are slow change of colour, dwarfing, with more or less rolling or curling of the leaves, and, finally, a wilt of the foliage and a falling down of the stems. The first symptoms in the tuber are nearly always at the stem end in the form of brown or blackened vascular bundles. During this stage of the disease the tubers are sound externally. The dark stain in the vessels may finally extend to the eye end of the tuber, the parenchyma within and without remaining sound and white, becoming yellowish as the fungus invades it (finally shrivelled, greyish brown, and hard), or else breaking down with mixed infections, including soft bacterial rots.

Preventive Measures.

As the fungus enters the plant below the surface of the ground and may gain access at any time during the season, it is very difficult to combat. Spraying with Bordeaux mixture and other fungicides has not been tried, but as these can be applied readily only on the tops there is little reason to expect beneficial results. Adding chemicals to the soil as fertilisers might be expected to help ward off the disease, but so far as experiments have been carried out they have given practically negative results.

Planting on soil free from the disease with sound tubers obtained from localities where the disease does not occur is certainly to be recommended. The stem end of the tuber should be cut off and inspected before deciding

Fig. 6.—Dry Rot (*Fusarium solani vel oxysporium*).

to plant it. It is much easier to keep this fungus out of a soil than to overcome it. It should be regarded in the light of a very noxious weed.

If tubers affected by this disease are used for seed the resulting crop and successive crops will be attacked, as the fungus is thereby placed in the best possible position to infect the young roots, even if it does not grow into the new plants directly through the sprouts, which it is extremely likely to do.

It is of equal importance to avoid planting potatoes for several years on land where the disease has appeared, as the fungus keeps alive in the soil for some time—how long has not been determined, but in several diseases of this type it is known positively that land once infected remains infected for many years. Such infected land should be used for other crops, preferably cereals or grasses. Badly-diseased tubers should not be fed to stock, as the heat of the animal body for so short a time is not sufficient to kill the spores, nor would the digestive fluids be likely to do so, and they would be thrown out on the land, ready to attack another crop. They should be burned, or buried on waste land in a deep pit with some barrels of caustic lime.

When the potatoes are harvested, the extent of the disease in those affected is usually comparatively slight, often quite unnoticeable to the casual observer. It is while they are in storage that the greater amount of destruction, and consequent loss, takes place. It becomes of very great importance, therefore, to know how to handle these slightly-diseased potatoes, so as to prevent further progress of the fungus. Potatoes that show a slight trace of brown colour in the flesh at the basal end should be boiled for stock food, or even for domestic use. There is no danger in using partially-affected tubers, as cooking kills the fungus, but even if they were eaten raw the fungus could do no harm to a human being, as it cannot grow at blood temperature 37½ degrees C. The fungus can grow readily and even rapidly in the tubers in a very dry air, but in a moist atmosphere there is a much greater production of mycelium on the surface, and consequently more spreading of the rot by contact. Furthermore, the tubers killed by the fungus, if kept dry, shrivel up and undergo no further change, but if there is moisture present they are invaded by various soft bacterial rots that may spread into the sound potatoes by contact, and thus increase the loss.

Galls caused by Eel-worms.

Some potatoes recently imported have been found to be infested with this dangerous pest. The symptoms are numerous nodules, or wart-like excrescences on the tuber. Tubers so affected should on no account be used for seeding purposes.

Late Blight or Rot, or Irish Potato Disease

(*Phytophthora infestans*).

The Queensland Department of Agriculture has reported to the Department of this State that the potato disease *Phytophthora infestans*, commonly known as "Irish Blight," has appeared in the south-eastern corner of that State.

This is a matter of vital importance to the potato-growers of this State, more particularly to those in the North Coast, who should scrupulously avoid importing for the approaching planting season any seed from Queensland which can possibly have been infected with this dread fungus disease. It has been long known to exist in New Zealand, and has done incalculable damage there to the potato industry, besides blocking Australian ports to any potato seed from the Dominion.

It is a matter of congratulation that the Queensland Department has promptly detected this disease, and it may be confidently expected that they will take energetic steps to stamp it out entirely, and thereby save the whole of Australia.

Preventive Measures.

So far the blight has not been found in New South Wales, and our growers have, therefore, the opportunity of taking, during the forthcoming season, every precaution to prevent the introduction of this terrible disease to their potato areas. This is a case when prevention is the only certain cure.

The first thing to remember is that the blight is a disease that can be introduced by means of affected seed-potatoes, or by the bags or particles of rubbish which have been in contact with potatoes affected by the disease. It can also be introduced by means of peelings and rejected portions of diseased potatoes obtained for household use.

The potato-grower who, during the forthcoming planting season, fails to carefully scrutinise every potato or portion of a potato that he uses for seed, or who allows second-hand potato bags of unknown origin to be dumped about his place, or who fails to take every precaution that ordinary common-sense may suggest, is liable to inflict severe injury to his own interests, and also to the interests of every other potato-grower in the State.

Mr. T. W. Kirk, Biologist to the Department of Agriculture in New Zealand, has had great experience of the potato blight, which for several seasons past has caused a direct loss of nearly a quarter of a million sterling to the potato-growers of the Dominion. He says the blight is almost wholly propagated and carried on from season to season in the sets themselves, so that the importance of clean seed cannot be too strongly insisted upon. The disease may also hibernate in refuse from a potato field, and such material may serve as a source of infection during the coming season. It is especially important to remember that this disease can live in warm districts during the winter on tomatoes and petunias, besides other plants belonging to the natural order *Solanaceæ*, of which the potato is a member. Hence, an apparently harmless garden flower like the petunia could be directly responsible for the spread of this disease. In New Zealand tomatoes proved to be very liable to the potato blight, and not only were large quantities of tomato fruit destroyed, but it was found that immense quantities of spores of the disease were produced on the affected fruit, and the least breath of wind scattered them far and wide. This experience serves to emphasise the importance of rooting out any odd and neglected tomato plants growing in the vicinity of the potato crops.

Fig. 7.—The first symptoms of Irish Blight in potato foliage.

The first indication of the disease is to be seen on the leaf in the shape of a slight reduction in the intensity of the colouring-matter of the leaf. This is rapidly followed by the appearance of small brownish blotches, commencing generally at the edge of the leaf. These spots soon increase in size, and the tissues die, turning dark brown or nearly black. In dry weather these patches do not increase much, but in humid weather they spread over the leaves with immense rapidity. After destroying the leaves, the disease travels down the haulms, and in severe cases the whole of the aerial portion of the potato plant may within a few hours become a blackish mass of rotten plant-*débris*, which emits a most characteristic and evil odour. If the under-surface of the leaves be examined with a pocket-lens, there will generally be seen around the margin of each spot a more or less distinct border of whitish mould, looking somewhat as if fine flour had been sprinkled on the leaves. This white mould is the fruiting portion of the fungus causing the disease, and as myriads of spores are quickly formed on each leaf, it is easy to understand how it can spread so rapidly.—T. W. Kirk, Biologist, New Zealand.

The appearance of diseased tubers is very characteristic. Numerous sunken, dead, brown patches are developed on the surface of the tubers. These may remain firm and hard for some time, but generally they become soft and the whole tuber rapidly rots. This rot is accompanied by a particularly fœtid odour, quite distinct from that of the rots caused by bacteria, fusarium, &c.

Provided that due precautions have been taken to plant none but healthy seed-potatoes, the only means of infection of the growing crop is by means of spores blown by the wind from diseased plants—potato or others as indicated. A single affected tuber planted in a crop can serve as an infection centre for a whole district. When the spores settle on the foliage of a healthy potato plant, they immediately take root in the tissue of the leaves and cause black blotches. These blotches rapidly increase in area, and in an incredibly short time the disease spreads down the stems, until it reaches and destroys the tubers. Spores falling directly, or washed by rain, into contact with exposed tubers, rapidly set up the disease.

Mr. Kirk recommends spraying the potato crops with Bordeaux mixture:—

4 lb. sulphate of copper.
4 lb. lime. (If good fresh lime is not obtainable, use 5 lb. of ordinary washing soda instead of 4 lb. lime.)
40 gallons water.

The mixture is applied as a preventive when the plants are 6 to 9 inches in height, and again when in bloom. It is very important that the spray should reach the under surface of the leaves, as it is there the spores find readiest ingress to the tissue. The consensus of evidence of New Zealand potato-growers is that this preventive treatment is efficacious, but it is far cheaper for all concerned in New South Wales and other portions of the Commonwealth yet free from the scourge to prevent the introduction of the disease, of which, luckily, there is such timely warning.

From perusal of all available literature of recent date concerning the potato blight, it is pretty evident that spraying is just so much money and time wasted unless the Bordeaux mixture is applied before the spores have gained hold of the plant, and that the spraying is renewed immediately after rain, and at sufficiently short intervals to ensure a coating of the mixture on the leaves all the time that spores may be floating about.

In the State of New York, in America, losses to the extent of two and a half millions of pounds sterling have been caused by the potato blight in a single season. In 1902 a ten-years' series of spraying experiments with Bordeaux mixture was undertaken, and from the last report to hand (1908) it appears that the experience of seven years points to the great efficacy of the spray when thoroughly done. All authorities in America and Europe agree with Mr. Kirk, of New Zealand, as to Bordeaux mixture, but the formula differs in different countries, and it will be found safer, if there should be occasion to spray, to use the New Zealand formula above-mentioned, as the one which has proved to be effectual under conditions somewhat akin to our own.

The Slaughtering of Pigs

H. W. POTTS, Principal, Hawkesbury Agricultural College.

The class of Bacon desired.

In order to successfully cater for the demands of the consumer and the curer, considerable modifications have been introduced of late years in the methods adopted of killing and preparing pigs for bacon. Formerly, a fat class of bacon was relished, more especially by people living in the colder climates where the maintenance of animal heat and energy is probably the stimulating factor in the selection of this class of flesh. Here, however, climatic conditions are very different, with the prevalence of higher temperatures the general demand is for a tasty, mild-flavoured, somewhat lean bacon, finely streaked with fat, and of firm texture.

It is not proposed here to deal with the methods and appliances employed in the curing of pork or bacon on a large scale. The aim is more in the direction of assisting the farm householder and bacon curer, who may handle small numbers of pigs, to intelligently grasp the principles and practice associated with preserving pork and curing bacon.

Pigs that are unsuitable for Bacon.

The primary consideration in the selection of pigs for slaughter is health.

The most serious ailments we have to encounter are Tuberculosis and Swine Fever. The former is the more prevalent and insidious. The symptoms of the latter are of such a pronounced character as to promptly lead to detection. Full particulars of this disease will be found in this issue, p. 656.

We find Tuberculosis more prevalent in the dairying districts where pigs are fed on skim milk, and when the simple precaution of scalding or pasteurising it is neglected. The old rule "never kill an animal for human consumption that is losing condition" is worthy of consideration. Such condition indicates, in many cases, the existence of some form of wasting disease.

Pigs suffering from any abnormal condition or treatment creating feverishness or a rise of temperature, are not fit to kill. Animals recovering from disease, or the results of accidents such as bruises, when slaughtered immediately afterwards do not provide a presentable or relishable class of flesh, and are difficult to cure.

Pigs driven hard, excited, or subject to alarming conditions, do not die well. The flesh has a tendency to sourness, is tough, and not appetising.

Animals low in condition from improper or insufficient food, apart from ill-health, fail to give a class of flesh which appeals to the consumer.

Inferior Flesh or "Softness" in Pork and Bacon.

It is occasionally found, in dealing with carcases for either pork or bacon, that there exists an abnormal condition in the texture or fibre of the flesh. It is soft, yields to pressure, is flabby, and possesses an unnatural greasiness.

This class of flesh invariably cures badly and produces inferior bacon.

Observation has taught that this is mainly due to the class of food being used in improper proportions.

Further experience has shown that this influence is more pronounced during the winter months.

Low temperatures exert a change upon the nature of the body fat. Animals exposed to cold are prone to give an oily class of flesh, whereas when the animal is kept warm a firmer bacon results.

When pigs are fed solely on maize we find the highest proportion of "soft" sides. Other foods such as oil-producing seeds, rape, linseed, &c., rice-meal, distillery waste, and brewers' grains are liable to produce soft bacon if pigs are fed on this class of food alone. This points to the judicious balancing of the ration. As a general rule, not more than one-third of the total ration of concentrated foods should be provided by these, especially towards the end of the fattening period.

Similar precautions must be exercised in using foods with a high moisture content, such as pumpkins, mangels, potatoes, fruit, green vegetables, turnips, melons, and beets. When fattening off, this class of diet should be largely reduced, more especially just before the animal is slaughtered. Excess in feeding any green crop, or even succulent pasturage or herbage, just before killing, renders the flesh unsuitable for curing.

Probably the cheapest concentrated food available to counteract this tendency is the locally-produced copra cake. Where foods of the class mentioned are available the addition of copra cake will tend to correct the growth of "soft" flesh.

An exclusive meal ration from any of the cereals, either barley, wheat, or oats, and especially rye, will occasionally be responsible for "soft" flesh. The addition of skim-milk is useful in feeding the cereals to overcome this trouble.

Where pigs exhibit ailments or are slow in assimilating food, "soft" flesh will be found. So long as the thrifty condition of 1 lb. per day live weight increase is maintained, a sound keeping flesh will be secured.

Any pigs slaughtered in low condition may be looked on as poor baconers, and are liable to give "soft" bacon.

Essential Qualifications.

A juicy, tasty meat must be well intermixed with fat, and attractively marbled. In a lean and ill-bred animal the meat is tough, dry, and badly flavoured.

The ideal flesh is only obtained from healthy, well-bred stock in good condition.

Sucking pigs can be killed as early as six weeks old for pork.

The best class of bacon is only got from young pigs, ranging from six to eight months old (the earlier age being given preference) weighing from 150 lb. to 200 lb.—120 lb. to 160 lb. dead weight.

How to Slaughter.

One of the chief aids to success in curing pigs for bacon lies in the precautions adopted for having the animal well bled and the veins thoroughly drained. To this end, the pig must be starved and have absolute rest for twenty-four to thirty-six hours prior to slaughter. He should have access to abundance of fresh, clean water. The animal must be freed from all elements, such as the noise of whips or dogs, which create pain, fear, anger, or excitement. The presence of strange animals or any disturbing influence must be avoided in order to secure a clean, sweet, relishable flesh. Moreover, every precaution should be observed to handle the animal quietly, and avoid bruising the flesh.

Engorged blood-vessels, the presence of undigested and partly fermented food in the alimentary tract, and bruises, give unsightly, sour flesh, and objectionable flavours.

When to Kill.

The selection of the best time for killing and curing demands consideration. It is desirable to have a dry, cool atmosphere, ranging at night from 34° F. to 40° F. These conditions are generally found in the months of July and August.

Select a place for killing, dressing, cooling, and curing free from dust and the presence of flies and other insects, and also of objectionable odours of any kind.

Necessary Equipment.

The preliminary preparations should include an equipment to conduct the various operations :—

- A boiler to heat water.
- A good supply of water.
- Scalding tub or vat.
- A strong table, log, or block.
- A sticking-knife, sharpened at both edges, about 8 inches long.
- A hammer with long handle, or axe.
- Hooks.
- A special hook for removing toe-nails.
- A double swivel-hook.
- Gambrel, of iron or wood. (The best is galvanised iron, provided with swivel eye.)
- A wooden spreader.
- A draining block for the pig's mouth.
- Dressing knife.
- Steel.
- Saw.
- Cleaver, chopper, or axe.
- Scrapers.
- Thermometer.

Fig. 1a.—Pig-slaughtering Equipment.

1 and 14. Bar hooks.
2 and 9. Swivel hooks.
3. Special hook for removing toe-nails.
4. Swivel gambrel.
5. Simple gambrel.
6 and 10. S hooks (various).
7. Steel.
8. Skinning and butcher's knives.
11. Long hook for removing entrails.
12. Ear markers, ear piercers, and nose piercers.
13. Floating and copper-cased thermometers.
15. Scraper (part of old scythe blade).

Slaughtering.

The pig is driven leisurely into a clean, dry pen or stye, and stunned with a smart blow on the forehead between the eyes with a long-handled hammer or back of an axe, or other handy implement (Fig. 1b 4). Stunning is not always practised, but for the inexperienced operator it is advisable in order to more readily handle the animal whilst sticking and bleeding.

Fig. 1b.—Pig-slaughtering Equipment.

1 and 2. Patterns of band saws.
3. Tenon saw.
4. Light hammer for stunning pig.
5. Cleaver.
6. Chopper.
7. Hot iron brand for branding pigs or sides of bacon.
8. A handy type of pickle pump.

In this helpless condition the pig is either hung up by one leg (Fig. 2) to the swivel-hook in the roof of the shed, or he is firmly held on his back by an assistant (Fig. 3).

In each case the long sticking-knife is employed, keenly sharpened on both edges. It is inserted in the pig's throat immediately in front of the breast-bone, with the point toward the tail, and firmly forced forward in a direct

line with the backbone for 6 or 8 inches. With a dexterous move of the wrist, the blade is turned at right-angles, and withdrawn. This movement severs the arteries on both sides just inside the breast-bone, near the windpipe, and the blood spurts freely. Full and exhaustive bleeding should be induced. All muscular movement and struggling facilitates bleeding, and should not be checked.


Fig. 2.—Cutting throat of stunned pig.

Scalding.

At this stage scalding-water should be ready, also three hooks, 8 inches in size, sharp at the points. One is hooked into the lower jaw, and one into each gambrel of the hock, or, in other words, between the ligament and the bone below each hock (Fig. 4). With the aid of these hooks, the carcass can be lifted into the scalding vat. This is a wooden vessel, 8 feet long, 2 feet deep, and 3 feet broad at the top and 2 feet 6 inches at the bottom. A tub or barrel will answer. This vat is three-quarters filled with hot water ranging in temperature from 165° F. to 175° F.

The exact temperature is quoted variously by different authorities. In this, however, we are quoting from lengthy experience here, and record it as the most useful.

The carcass should be immersed and kept moving, the object being to prevent unsightly reddened patches appearing on skin after scraping. The operation of removing the dirt, scurf and hair, will be facilitated by adding 2 oz. caustic soda, or a pound of washing soda to 20 gallons of water. After moving the carcass and soaking it for some time, it will be found that the hair and scurf is readily detachable. Lift the carcass on to the table or framework over the vat (Fig. 5).

There are various forms of scrapers made for the purpose. One may be improvised by cutting an old scythe blade into convenient sections, or use an ordinary knife. When scraping start with the head and feet. Continued applications of hot water may be made during the scraping process. See that the nose, ears, and feet are made sweet and clean. Finally wash down and remove any remaining patches of hair and scurf with a sharp knife.

Fig. 3.—Holding stunned pig while throat is cut.

Fig. 4.—Hooks inserted, ready to lift carcase into scalding vat.

Fig. 5.—Ready for scraping.

Fig. 6.

Remove the toe-nails with the special hook (Fig. 6).

A gambrel is inserted through each hock to hold the animal in rigid position. A rope is passed through the gambrel to a double swivel hook in the roof of the shed, and the pig is hoisted to a suitable working height. Wash the carcass down again with hot water, and make a further effort to remove stains, scurf and hair. Then wash again with clean cold water.

Fig. 7.

With a keen-edged dressing knife cut all round the tail and the head of the back passages (Fig. 7) to release them from the surrounding tissue. Split the skin between the hind legs. A free incision is then made right along the central line of the belly, between the rows of teats running along the breast-bone, and terminating at the jaw (Fig. 8).

Fig. 8.

This cut should be made firmly and deliberately, deep enough only to cut the true skin. Open the body up, place the fingers of the left hand inside the flesh to guide the knife point and prevent it from perforating the intestines. Cut through the breast-bone.

Grasp the intestines just below the bladder, pass the knife blade in circular fashion upwards around the bony structure, and release all the back passages and bladder.

Draw these forward and outwards. The kidneys which are attached to the backbone, associated with the kidney fat, are next exposed. At this stage leave them.

A cross cut is made to the backbone, under the kidneys, around the diaphragm or partition retaining the intestines.

Fig. 9.

The whole of the entrails, including the large and smaller intestines, spleen, liver, gall bladder, stomach, heart, and lungs, right down to the tongue, are removed, including the windpipe and gullet. The tongue may be left in the head until a later stage.

Insert a spreader about 1 foot long into the flanks to keep the carcass open for cooling and draining (Fig. 9).

Another piece of wood 4 in. x 1 in. is now passed between the teeth to release drainage through the mouth.

The interior of the carcass is washed throughout with clean cold water, the edges trimmed, and all left to drain and cool in a dust-free, healthy, dry, cool atmosphere, for twenty-four hours.

Fig. 10.

Cutting Up.

At the conclusion of the cooling period, and provided that the flesh is firm and set, the process of cutting up may be taken in hand on a firm table or block, or while the carcass is suspended (Fig. 10). Cut off the four trotters at the fetlocks.

Remove the head by inserting the knife deeply around the neck half an inch behind the ears. The operator then seizes the head, and the attendant

Fig. 11.

firmly grips the forearms, and both simultaneously make a strenuous and sudden movement in opposite directions, with the result that the head is screwed off the spinal column.

Remove the tongue. The head, tongue and trotters can be sent direct to the kitchen to be cooked fresh or kept in a tub of brine for a week or two.

Attention is now directed to the backbone or spine. A deep incision is made with the knife close to the bone from the tail to poll (Fig. 11).

Fig. 12.

Saw the ribs from each side of the backbone (Fig. 12).

Lay the sides flat on the table with the fleshy portion exposed (Fig. 13).

We now have to deal with the lard, fat and kidneys. Commence near the flank, and seize the layer of leaf lard, and gradually peel it away from the back. In tearing this layer off take with it the kidney on both sides.

Fig 13.—Removing Lard, Fat, and Kidneys.

The strip of lean meat under the loin is inferior and fibrinous, and difficult to cure, hence it is best to remove it.

Trim the sides neatly all round, and remove all rough edges of bone, blood and stained pieces.

If it be intended to cure the complete side, no further dressing or cutting is required.

Where it is desired to cut off the ham, an incision is made in a slightly circular shape, commencing at the flank to detach it from the flitch (Fig. 14).

Fig. 14.—The side divided into Shoulder, Middle, and Ham.

The shoulder also can be made into ham. In this case the cut is made between the fourth and fifth rib.

The side is now ready for curing in three pieces.

This necessitates free trimming and shaping. All the trimmed pieces are useful for sausages.

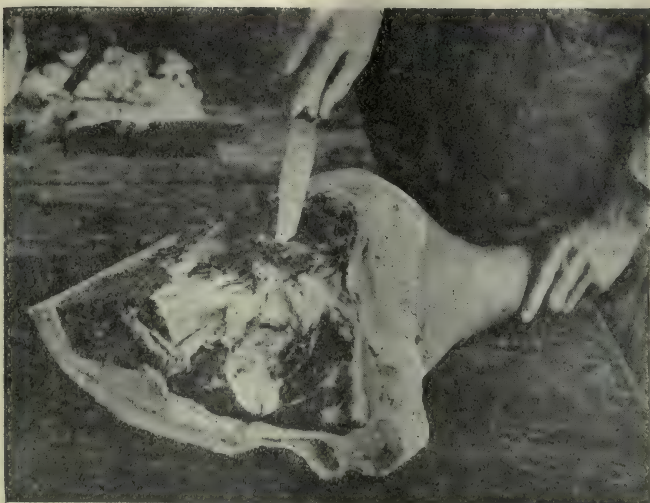


Fig. 15.—Removing the Joint Oil.

Fig. 15.—The cavity of the joints in both shoulders and hams are receptacles for joint oil. This, if left, is liable to decompose, and it is best released and well washed out with brine. In each case the joint will require to be punctured.

(To be continued.)

New Varieties of Maize for Trial.

It has long been recognised that most of the varieties of maize that years ago could be relied upon to produce, under anything like fair conditions, abundant yields of grain or of green fodder have deteriorated a great deal. In order to ascertain whether any more prolific varieties could be procured for trial this season, it was arranged that Mr. Inspector Ross should visit certain favoured maize districts of Victoria to make a selection of seed.

In his report to the Chief Inspector of Agriculture, under whose supervision the trials will be conducted, Mr. Ross states :—

In visiting such centres as Lindenow and the flats on the Tambo and Snowy Rivers, the principal feature which presented itself to my mind was the enormous yield of maize per acre obtained in those localities—yields of from 100 to 120 bushels per acre are rather the rule than the exception—and I do not think that the soil and climatic conditions are altogether responsible for these heavy yields. Both soil and climatic conditions at Tumut appear to me to be somewhat similar to those existing in the localities which I have mentioned.

For years past the maize-growers at Bruthen, Mossiface, and Orbost have endeavoured, and apparently succeeded, in introducing new varieties of maize entirely suited to Australian conditions.

The cultivation methods employed by these successful growers are, however, slightly different to those which are being practised by maize-growers in this State, for, while many of our farmers sow their maize continuously in rows, 3 feet apart, the Victorian growers have universally adopted the system of check planting, that is to say, while the rows are 3 feet apart, from two to three seeds fall out of the check planting machine automatically every 3 feet, thus permitting the farmer to horse-hoe in two different directions, whereas in the case of continuous sowing, horse-hoeing can only take place in the rows, but not between them. The quantity of seed used is from 10 to 12 lb. per acre.

In selecting the different samples of maize cobs which I have forwarded to you, not so much attention has been paid to size of cob as to characteristic type, closeness of rows, shape of grain, and good tips and butts. The method employed in selecting these cobs was as follows :—Out of the barn or crib, about 3,000 cobs which appeared at first sight to have all the necessary qualifications were selected, from these again a final choice was made, and sufficient cobs gathered in each instance to allow for a little over 1 bushel of shelled grain.

The varieties selected by me are the following :—

1. Sibley, from Warren Bros., Bruthen. This is a variety greatly favoured by Victorian growers. The particular sample which I am sending, yielded this season 132 bushels per acre. It is not an early variety, and requires to be sown not later than the end of November.

2. Early Leaming, from J. McEwan, Bruthen. This sample only shows in parts the characteristics of Leaming ; through constantly having been grown in close proximity to Sibley it has become a hybrid between Leaming and Sibley. It is, however, a maize of good yielding qualities, both for fodder and grain ; it is slightly earlier than Sibley.

3. Early Yellow Dent, from D. Price, Deep Creek, *viâ* Bruthen. Of all the varieties that have come under my notice of late years, this one appears to me the very best. Apart from its excellent yielding qualities—120 bushels to the acre—this maize has the great advantage of maturing five to six weeks earlier than any other. I have known this maize to have been thrashed and sold in the Melbourne market before picking had commenced with the other varieties. Its earliness, and also its thin succulent stalks, mark it as a maize which should prove a boon to dairy-farmers. My experience has led me to the conclusion that a maize bearing thin stalks will prove to be more advantageous as a green fodder, fed to cattle directly from the paddock, than a variety possessing a thick, coarse stalk ; for, while in the former case cattle will eat the whole of the thin stalk, they will invariably leave a certain amount of a coarse stalk, and so let it go to waste. This variety should be sown a little closer than the others, 2 feet apart in the rows, and it can with safety be sown to the end of December.

4. Funk's Yellow Dent, from James Fisher, Orbost. A lately imported American variety, acclimatised to Australian conditions. Its chief characteristics are the beautiful wedge-shaped grain, closeness of rows, and especially its well-filled tips and butts. It is not an early variety, but among the late-maturing ones it appears to me to hold premier position as a maize for grain. Yield, 110 bushels to the acre.

5. Longfellow, from Nixon Bros., Orbost. A flint variety, whose sole merit lies in the fact that it is a very early maturing maize, bearing thin stalks and a large number of suckers, thus making it a valuable fodder plant for dairy purposes. Its grain-yielding qualities are fully 25 per cent. to 30 per cent. below that of other varieties selected by me, and for that reason it would appear at first sight that its cultivation for grain purposes would be unprofitable; but for the farmer who combines maize-growing with dairying, it may prove a good variety to grow on account of its many suckers, which will come in as green feed in summer months, and also on account of the fact that its stalks, after the maize cobs have been picked off, are of greater feeding value than dry stalks of any other maize varieties. Yield, 70 bushels per acre.

6. White maize, name unknown, from Waller Bros., Orbost. A rather late maize, but an excellent yielder, both for grain and fodder purposes. The crop from which this sample was taken yielded 110 bushels per acre. It requires to be sown early.

Before shelling the cobs it would be advisable to cut the tops off to an extent of 1½ inches, and the butts 1 inch. By doing this it will ensure getting a uniform sample of grain.

I am sending, also, three samples of imported maize given me by Mr. Elwood Mead. The one referred to as Red Kentucky Moonshine appears to me to be of exceptional quality.

Potatoes.

Mr. Ross also made inquiries as to obtaining some new varieties of potatoes. Concerning this matter, he says:—

In making inquiries *re* the most suitable varieties of potatoes in different districts, I have heard many diverse opinions. Experiments conducted by the Victorian Department, and also by private growers, point to the fact, however, that the following varieties of potatoes are the most favoured:—

- Beauty of Hebron, early.
- Brownell's Beauty, main crop.
- Early Rose, early.
- Factor, main crop.
- Carmen No. 1, very good all round variety, both for early and main cropping.
- Scottish Triumph, main crop.
- Sensation, suited for poor soils.
- Up-to-date, one, if not the best, of main croppers.
- Vermont Gold Coin, main crop.
- Warrior, main crop.

There is one matter I beg to draw your attention to, and that is, the tendency on the growers' part to go in more extensively for white-skinned potatoes than has been the case hitherto. While it is admitted that there is a stronger demand for red skins than white skins, the red potato, in some cases at any rate, has nothing more to recommend it than the colour of its skin.

It is claimed that every potato eventually finds its way to the kitchen, and from an economic point of view, it will be admitted that the tuber which boils the best, and occasions least waste in shape of peelings will eventually find its way to favour, even though it possesses a white skin. Such sterling varieties as Carmen and Scottish Triumph, I feel sure, will, in time, break down the prejudice existing in favour of the red skinned varieties.

Through the courtesy of Mr. Seymour, the Victorian Potato Expert, I have secured 3 lb. parcels of the following varieties for trial this season:—

- Clark's Main Crop.
- Brown's River.
- Cook's Favourite.
- Up-to-date.
- Scotch Greys.
- Black Prince.
- Copper Skin.
- New Zealand Pink Eye.
- Sutton's Abundance.
- Carmen No. 1.
- Bismark.
- White Prolific.
- Blue Prolific.

These varieties will be sown in a suitable piece of land, with the view of accumulating sufficient quantities of seed for future distribution.

Strawberry Clover.

While in Gippsland, Mr. Ross took the opportunity to inquire if plants of strawberry clover could be obtained.

The results which have been obtained from this plant are really wonderful. Badly drained, sour patches, overgrown with rank, coarse grasses, have been planted with strawberry clover roots about 2 feet apart. The first year's growth has the effect of killing this rank growth, and leaving a green carpet of clover. At Orbost, Messrs. Nixon Bros. are fattening 500 bullocks on 320 acres of Strawberry Clover.

The method of planting is simple: a sod of roots is chopped up with a spade, in pieces about 1 inch to $1\frac{1}{2}$ inches long; the pieces are then broadcasted, and a heavy roller run over the land. Mr. Ross is of opinion that some of the land at Tumut would be suitable for the plant, and arrangements have been made to obtain sufficient roots for a trial of at least an acre at Tumut this season. Mr. Ross was informed that the best results are obtained by planting early in August.

Maize Smut.

Maize smut occurs wherever maize is grown, but is much more rare in cold districts than in warm. The loss from maize smut, while in cold districts not often exceeding 15 per cent. of the crop, may in warm districts reach as high as 60 per cent. of the whole crop, or even ruin the crop utterly. While it is believed that wet seasons are more favourable to the appearance of smut, there is no doubt that crops suffer much even in the driest of seasons.

The spores of this smut are formed on any above-ground parts of the plant, in masses varying in size from that of a pea to that of a man's fist. The ear is the part most affected. Often part of the ear is smutted and the rest not, all that part above the smut being abortive and producing no good grain, but that part below the smut giving rise to perfect grain. This fact is often a source of danger to the economically-inclined farmer. Such ears, with the smut carelessly removed, are harvested and stored with the sound ears; the spores of the fungus are thus distributed through a great quantity of sound grain, which, if used for seed, of course gives a smutted crop. If, therefore, such ears are to be harvested at all, they should be stored by themselves, and used with proper precautions.

Preventives and Remedies.

1. Avoid seed from smutted crops and smutted districts.
2. Treat the seed with bluestone or hot water, the same as for wheat.
3. Collect all smutted parts of the plant and burn them.
4. A rotation of crops tends to reduce maize smut.

Citrus Fruit Growing at Brewarrina.

THE method of irrigation employed by Mr. Walter Piggott, Ellerslie, Cato Creek, Brewarrina, is his own idea, evolved to suit his conditions, position, and supply of water.

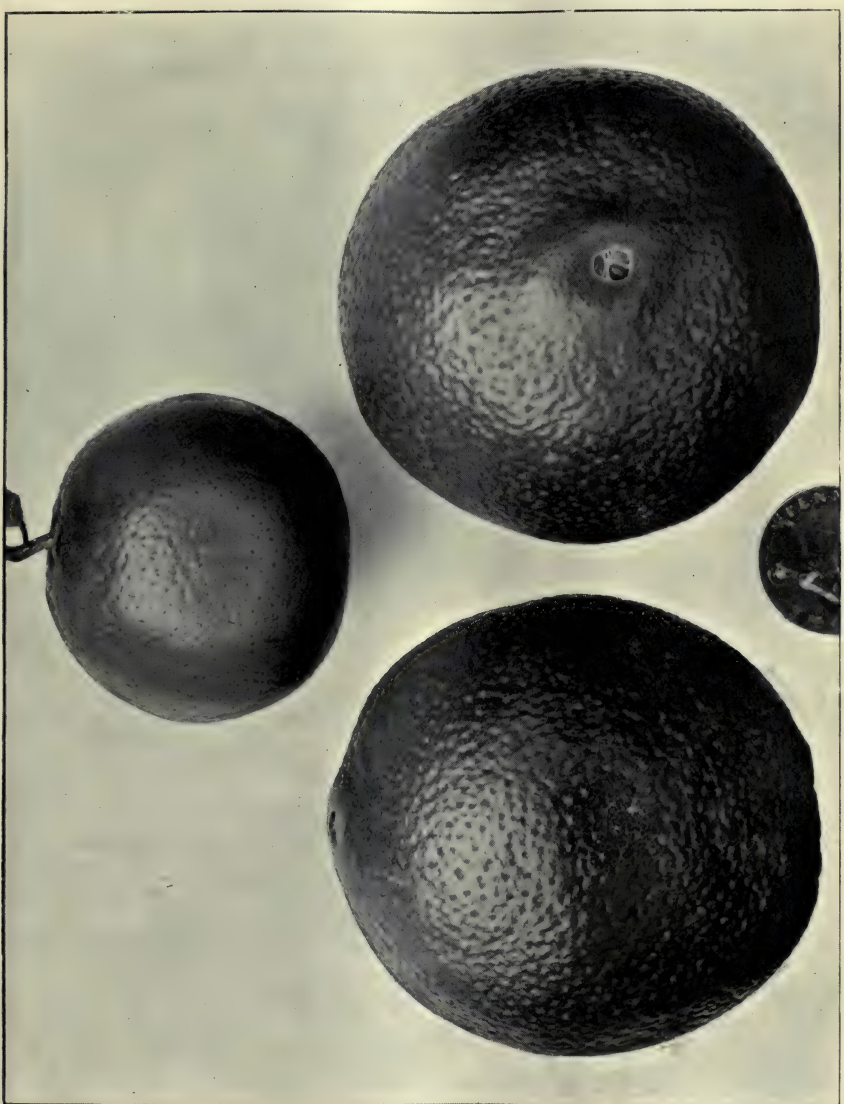
Cato Creek is not permanent, being dependent on the overflow of the flood waters of the Barwon, consequently Mr. Piggott's operations are restricted to an area in proportion to the water available.

The water is raised by a 4-horse-power steam centrifugal pump from the low-water mark into a tank set up on piles. The total height the water is pumped is 36 feet, and then run off from the tank by piping and a galvanised-iron channel to the highest portion of the orchard. The ground slopes gently towards the north, and is surrounded on the south and west by an African box hedge. In passing, Mr. Piggott mentioned that the African box makes a good protective hedge against hot or heavy wind, but its roots spread so far that it would not be advisable to plant trees nearer the hedge than from 20 to 30 feet.

The slope prohibits the orthodox irrigation channels between the rows of trees, so each tree is surrounded by a small basin (banked up by earth), roughly 8 to 10 feet in diameter. The water flows from the iron channel on to the ground channels from taps at convenient points, and into the basins around each tree, filling the basin to a depth of about 4 inches, and, backing out the top side, flows on to the next lower tree, and so on till the row is finished. The porous nature of the soil (which is of black light loam) does not permit the water to lodge any length of time, and so cannot harm the tree. The subsoil is of a harsh, sandy nature, devoid of plant-food. In ordinary weather, in about eight hours every drop of water has disappeared. In the heat of summer, evening and night watering is the rule, and, as evaporation is very great, a few hours only will have elapsed when all the water has been taken in. The conditions are such that no rule-of-thumb for irrigating can be adhered to: nine years' experience has proved when water is necessary.

During the winter, whilst citrus fruits are ripening and a little rain has fallen, it may not be necessary to irrigate one drop for months, while, on the other hand, during the intense heat of summer it will be found that irrigating once a week or perhaps oftener, or, again, perhaps once a fortnight or longer, will be required.

Some experts may not approve of the basin method of applying water, but the following facts may be of interest: Before adopting the basin method Mr. Piggott watered some grape vines by hand, but the white ants beat him



Navel Oranges grown at Ellerslie, Brewarrina.

The illustrations are about half natural size. The small orange is one of the best types of smooth-skinned oranges grown in the county of Cumberland. At the time this photograph was taken, this was the best class of orange procurable in city shops.

and all but ruined several vines. Then he built a channel with the vines in the centre, flooded the lot and exterminated the white ants. Since then all the grape vines and deciduous trees have been treated by the basin method, and not one has been attacked by white ants. He accidentally introduced codlin moth into his orchard by old fruit-cases. Their first appearance was in quinces, and their presence ruined that year's crop. When they fell to the ground beneath the trees, the water when applied filled the basins around the trees and drowned the pest. This wholesale destruction of the grubs may be unique, but it proved so effective that not a codlin moth escaped, and the pest has never appeared since. The whole orchard is lightly ploughed three times a year by a Planet Junior plough, and no other manure but a very light dressing of wood ashes has been used.

The varieties of oranges grown are Washington Navel, Old Parramatta, St. Michael, and the White Siletta; the last-named is not suitable for hot climates, but produces a fair-sized fruit in payable quantities. The Washington Navel is the most successful, closely followed by the Parramatta. The mandarins comprise three sorts in order of quality and quantity produced. First, The Emperor, then "Unishow" and Thorny mandarin. The grapes successfully grown are Black Amber, Black and White Muscatels, Baxter Sherry, and Gross Colman. The other fruits are quinces, apricots, nectarines, and several kinds of Japanese plums.

Speaking of apricots, Mr. Piggott stated that, without exaggeration, an apricot tree 6 years old produced over 100 dozen fine-flavoured, normal-sized apricots.

He also stated that, even though the young citrus trees he obtained from a nursery were supposed to be clean and free from scale, shortly after striking they developed it. His spraying mixture is as simple as effective, and consists of a bar of Sunlight soap shredded and boiled in 2 gallons of water till dissolved. When cooled down the mixture is applied by a Tyree spray of 2 gallons capacity. The proof of its application is the appearance of the trees and fruit: no trace of disease, scale, or parasite is visible anywhere. Mr. Piggott's assurance is that the mixture can be applied at any time, even when the trees are blossoming and will not harm them, but the spray is death to scale and all other pests. The trees are planted 18 feet apart in rectangular formation. Mr. Piggott estimates that his citrus trees yield 15s. worth of fruit each, or even more, in a season. Vegetables of all descriptions, especially tomatoes, thrive under his irrigating methods, and an area of lucerne about ½ an acre in extent yields from 6 to 8 cuts annually. With regard to the lucerne, it was necessary to level the ground before the seed was sown, and it is irrigated by flooding the paddock in beds.—J. A. SNOW.

A collection of oranges and mandarins from Mr. Piggott's orchard was obtained by Mr. Alderman McElhone and exhibited in the show windows at Challis House last month.

The Clearing of Areas for Cultivation or for Pasture.

In most districts the cost of clearing is the deadweight of expenditure with which the enterprise of the settler is loaded. Some land can be readily and cheaply cleared, some land is scarcely worth clearing at all by any of the present known methods, and thousands of acres of really productive land are passed by because for lack of knowledge as to the way to set about it, the task of clearing the timber is regarded as insurmountable.

From time to time writers in the *Agricultural Gazette* have described methods of clearing that have been practised successfully in various districts, but the field has not been covered by any means, and in view of the importance to newcomers in any district of exact and reliable advice as to the most effective means of clearing areas for the plough or for pasture, notes from those who have carried out the work will be highly appreciated.

Clearing Brush Lands in Gloucester District.

Mr. John McKenzie, of Gloucester, in detailing his experience with considerable tracts of country, states :—

In this district when we speak of brush land we mean undulating and hilly country densely covered with soft woods and soft and hard woods, intermixed amongst which is an undergrowth of various shrubs and vines. This country, although in parts broken and stony, is invariably a much richer soil than the forest country adjoining it. Up to the present time the great majority of old local residents have overlooked this fact, and when either taking up Crown lands or purchasing from private individuals endeavour to avoid the inclusion of brush country. Excepting on the Gloucester estate very little has been done in the neighbourhood of Gloucester by way of endeavouring to clear country of the character described. Still I have seen many instances in which poor forest country has been taken up and cleared at a much greater cost than would have been required to clear brush country which, if improved, would have been tenfold more productive. During the past three or four years we have cleared between 2,000 and 3,000 acres of brush country on the Gloucester estate. After many experiments we find the following to be the cheapest and most effective way of dealing with this country :—

Commence operations during the month of March, when the risk of running fires has passed. First with brush-hooks carefully cut all the vines and undergrowth ; then, if all softwood, fell everything. If there is hardwood through it, those up to 10 inches should be felled also, and the larger hardwoods ringbarked deeply, cutting right through the sap wood. In felling care should be taken to get the trees to fall as nearly as possible in the one direction. This gives a more even distribution of the fallen stuff and ensures a more rapid and effective burning. When the brush has been felled it should be left untouched for at least eighteen months. After that period it may be fired, but very great care should be taken in selecting the day to light it. Our greatest success in burning has not been on the hottest days or days when the wind has been strong, but on a day on which the atmosphere was dry and a light breeze blowing. It should be lighted as quickly as possible all along the side from which the wind is blowing, and on the low land first if the wind is favourable. If the brush so dealt with is softwood, after the fire nothing will be left but a few charred stumps, and the land is ready for sowing as soon as the ashes have cooled.

When brush has been felled during the cold weather no growth is likely to show through it till the spring, but with rains and warm weather up come many shrubs, weeds, and vines of endless variety, the seeds of which appear to be stored in the brushes waiting for sunlight to germinate. The result is a rank growth, increasing as time goes on, and in parts hiding the felled timber. Several varieties of softwood brush throw out suckers,

which by the second year will have grown to a height of 10 or 12 feet. To the inexperienced this gives an idea that there may be a difficulty in firing; as a matter of fact it rather aids the fire. The green growth is not amongst the decaying rubbish but above it, and seems to hasten its decay. It acts as a protection against rain; I have frequently noticed after heavy showers that rubbish so covered is perfectly dry. With the hot winds of summer soft weeds and vines, which would resist much hot weather if close to the ground, quickly shrivel when dependent on long spindly stems which have found their way through the rubbish by a long winding course, and burn readily with the dry material. If the fire is a success very few stumps sucker; weeds of various kinds come up but most of these are edible. Parramatta grass we find the most troublesome weed, but it only lasts two or three years. If grass seed is sown immediately after the fire it will continue to grow even amongst the Parramatta grass. Black thistles may be expected to come up in abundance, but they are an advantage. If the burn has not been a clean one, or Parramatta grass is very thick, the thistles make a second and a clean burn a very simple matter. When the thistles begin to wither and the down is abundant one match thrown down on a hot day will start a running fire which will cover the whole area in a very short time.

The cost of felling brush country here is 17s. 6d. to 20s. per acre, and this is really the whole cost of clearing if a suitable day is picked for burning. One intelligent man can fire thousands of acres in the day. The actual cost of clearing the average forest country on the coast districts is difficult to get at because it is done gradually; first ringbarked, then suckering and grubbing. This may require to be done yearly for some years. Finally, say five years after being ringbarked, it may be burned off at a cost of 14s. to 20s. per acre. For grazing purposes only many people do not burn the dead timber off forest country, and quite overlook the fact that brush country may be dealt with for grazing purposes in the same way. Brush timber requires to be more deeply ringbarked than forest trees, and some varieties take longer to die than forest trees; but after a brush is ringed and the undergrowth cut stock find their way into it, and that they get abundance of food is proved by their condition.

About eighteen months ago I had an area of brush country ringed, and in this paddock is also an area of dead forest. Shortly after the ringing of brush timber stock began to find their way through it, and now during the cold weather practically live there and are keeping their condition. In the course of a couple of years I expect a great deal of the dead timber will have fallen, when I hope to get a fire through this country and clear it at a much less cost than 20s. per acre. This, however, remains to be proved. Where we have felled or ringbarked brushes, gullies formerly dry have become running streams. The present was the driest season on record in this district, still springs from the hills where brush has been cleared never ceased to run.

Method of Preventing Rabbits from attacking Wheat and Other Crops.

Sir Joseph Carruthers, during a recent trip through the Monaro district, noted in several places that the selectors sow a strip of rye round their wheat and oat crops, for the express purpose of keeping the rabbits away. He says that the method is eminently successful, as the rabbits never attack the rye, and never penetrate through it to the other cereal crops.

In districts where rabbits are only just making their appearance, or where for any reason wire netting has not been used on fences surrounding the wheat crops, it would be very well worth the while of farmers to try this plan. Rye is a remarkably hardy crop, and can be sown as late as August. It grows fast, and if the usually roomy head lands around wheat crops that are generally left as a nursery for weeds were broken up and rye sown, the cost would be slight, and the possible benefit very great.

Rye produces an abundant yield of grain, is a valuable green fodder, and the straw is unrivalled for thatching; but it should not be made into hay, as for some reason rye hay is unpalatable to stock.

Birds and the Orchard.

C. T. MUSSON, Hawkesbury Agricultural College.

IN the Hawkesbury College orchard, rape was sown in late summer, to be ploughed under as soon as pruning is over.

This season it has been badly attacked by aphides, more particularly on the outer edges of the various blocks, the dry conditions prevailing from early March to end of May no doubt encouraging the visitation, as is usual.

For some weeks now we have had in the orchard a really remarkable visitation from our local birds;—they have certainly concentrated there in great force, drawn by the food attraction present in the aphides.

Some time has been devoted to watching their proceedings, and, whilst no birds have been killed to prove the nature of their food, the method of feeding, closeness of view obtained, with careful examination of many individual cases of plants fed from, and the general circumstances connected therewith, render the conclusions incontrovertible.

Taking the observations of one late afternoon in June as a good example of the birds found doing useful work, the following species were observed:—

(1) White Fronted Chat, or Nun (*Ephthianura albifrons*).
(2) Red Nibs (*Ægintha temporalis*).
(3) Yellow-tail Tit (*Geobasileus chrysorrhoa*).
(4) Yellow Tit (*Acanthiza nana*).
(5) Silver Eyes (*Zosterops coerulescens*).
(6) Blue Cap (*Malurus cyaneus*).
(7) Ground Lark, or Pipit (*Anthus australis*).
(8) Australian Sky Lark (*Mirafra Horsfieldi*).
(9) House Swallow (*Hirundo neoxana*).
(10) Fairy Martin (*Lagenoplastes ariel*).
(11) Willy Wagtail (*Rhipidura tricolor*).
(12) Pee Wee (*Grallina picata*).
(13) Jacky Winter (*Microeca fascinaus*).
(14) Sparrow (*Passer domesticus*).
(15) Starling (*Sturnus vulgaris*).

Just what they were doing, individually and collectively, must now be noted.

(1) **Chats.**—These birds were numerous, and were feeding whilst running about on the ground, from the ground under the rape, and were seen frequently to take food from the rape as high as they could reach. Examination of the plants seen to be fed from showed they were taking aphis (and in many cases, no doubt, the larvæ of the cabbage moth, found here and there). Under the attacked plants, on the ground, many aphides were crawling about, providing ample food for birds.

(2) **Red Nibs.**—Feeding about on the ground; seen taking seed from a tuft of annual goose grass, and from ground amongst spurrey; doubtless looking for seeds only; not an insect feeder.

(3) **Yellow-tail Tit.**—Working actually on the rape plants, as well as on the ground, around and under them. Seen taking aphis. Numerous.

(4) **Yellow Tit.**—Working over the trees; does not feed on the ground, as far as our observation extends; but aphides found on the twigs where seen feeding, chiefly on the few remaining leaves (peach). In small flocks.

(5) **Silver Eyes.**—Working in flocks on and about the rape; seen feeding from the plants. Numerous.

(6) **Blue Cap.**—Working over the ground amongst the rape plants. Aphides in plenty on the ground where feeding. A family of seven seen.

(7) **Ground Lark.**—Up to a score seen. They came in from the neighbouring cultivation paddock, and fed about on the ground under and amongst the rape.

(8) **Sky Lark.**—In feeding habits, same as the ground lark.

(9), (10) **House Swallow, Fairy Martin.**—Both birds in considerable number, the former most numerous. Flying about close down to the green rape, from 1 to 3 feet above the plants. On bending down, large numbers of tiny flying insects could be seen flying slowly about, almost in the nature of a thin cloud. By wetting the palm of the hand well with saliva, and waving it about as though netting, these insects could be trapped; they were aphides.

(11) **Willy Wagtail.**—At least twenty seen. They were seen to rest on a stake or branch of a tree, then to fly down to the rape and flutter along, bumping against the leaves for a yard or two, no doubt to cause flying insects resting thereon to fly, for this bird waits for flying insects, or, as in this case, will make the insects fly by disturbing them. Also seen taking insects from plants.

(12) **Pee Wee.**—Numerous. Working about amongst the rape plants. Likely enough aphides are small food articles for this bird, but when they could be taken by the dozen at a time, as was quite possible, it is probable that they were helping to reduce these insects in numbers.

(13) **Jacky Winter.**—Fairly numerous over the area, feeding on flying insects. Seen taking flying aphides and cabbage moth, and occasionally settling on the ground to pick up some food item.

(14) **Sparrow.**—Numerous. Seen feeding about on the ground amongst the rape plants. Watched taking aphides from the plants, and also from peach leaves.

(15) **Starling.**—A flock of 200 or more, feeding on the ground amongst the rape plants. Too shy to allow of approach, but from appearances probably making use of the plentiful aphis supply.

Summary.—It is understating rather than overstating the case, to say there must have been 1,000 birds on the 20 acres (about). The number of insects destroyed must have been very great: feeding twice a day, at least, for some hours, each bird would require a supply running into thousands at each feeding time. No doubt much of the good done relates to the prevention of egg-laying on the part of insects destroyed;—the good done is, therefore, cumulative.

These birds did not clear the aphides away; indeed, there hardly seemed to us any diminution in numbers, as far as the pest was concerned; yet it may be taken for granted that unless these birds had been at their natural work in feeding, the pest must have been wider spread, and there would have been no check on egg-laying. We must not forget, in this connection, the rapidity with which aphides reproduce;—fast as the insects are eaten, still there are plenty of parents to go on reproducing.

Even the sparrow takes part in the work of insect destruction; though, naturally, a seed-eater, this food-line is, perhaps, in the nature of an extra or luxury.

Taking this as an example of nature's workings, we cannot be surprised that our birds could not clear the insects out, though they are acting as a means towards that end, bearing in mind the dictum that "any animal becomes a serious pest only when excessive in numbers" (speaking especially of insects, and even birds themselves); also remembering that when insect numbers are about average, the birds succeed in keeping them so. Our aphis infestation is a case of an insect becoming unusually plentiful; the balance of nature is thrown out for a time; birds (nature's insect check) have concentrated where food is abundant, and are working up to their capacity in numbers and food requirements, and, given time, would no doubt bring the balance even again. Meantime, man steps in and puts an end to nature's methods by "ploughing under" the attacked plants, thereby destroying the wingless forms at once, the flying forms still being free to provide potential food for our bird friends.

Practical Instruction in Dairy Methods.

The Minister of Agriculture is determined that every possible step shall be taken to afford the dairy farmers and all concerned in our dairying industry every facility to acquire knowledge of methods that experience and scientific investigation have proved to be productive of the most profitable returns.

The dairy staff of the Department is now thoroughly organised, and every member is actively occupied as a missionary carrying the gospel of cleanliness and effectiveness into every part of the State where dairying is carried on.

The dairy instructors, who are all experienced dairymen and butter-makers, besides visiting the local factories, get into touch with as many farmers as possible, visiting the farms and affording practical instruction in any phases of the dairy work that the farmers may not have had an opportunity of learning how to carry out in the most up-to-date and satisfactory way. No doubt there are many farmers who are in no need of instruction concerning the treatment of their cattle, or of their milk or cream; but the instructors find that these progressive and generally successful dairy farmers appreciate the opportunity of exchanging ideas on matters of moment to their industry. There are others, again, who at first are inclined to resent, as interference with their private affairs, the efforts of the instructor to induce them to make some radical change in methods that are obviously prejudicial to the industry, as well as to their own interests; but generally speaking, the instructors find that farmers are showing a readiness to effect improvements in the provision for their cattle and in the handling of their produce. If in some districts the improvements are slow in becoming apparent, there will be found certain disadvantages in local conditions which take a long time to surmount.

The special instructional work in the public schools in dairying districts, inaugurated this season, is now in full swing, and the invitation to the lessons in use of the Babcock Milk Tester extended to the parents of pupils has been availed of at a number of centres.

Where there are a great many children of dairy farmers attending a school, the Instructor spends a second day there, so that every child 12 years of age and over receives a practical lesson. The Instructors report that most of the boys show intelligence, and are quick at the work.

ORIGINAL, DRAWN FOR THE AGRICULTURAL GAZETTE.

AMPHIPOGON STRICTUS, R.Br. Var. SETIFER.

Useful Australian Plants.

J. H. MAIDEN,
Government Botanist and Director, Botanic Gardens, Sydney.

No. 104. *Amphipogon strictus*, R.Br., var. *setifer*, Benth.

The normal species is figured in the *Gazette* for October, 1892, p. 748, but the variety now depicted is so different as to require individual treatment. The heads of flowers and the leaves are very different, and the variety *setifer* owes its name to the hairs upon the leaves. At the same time there are specimens which form connecting links between the various forms of *Amphipogon strictus.*

Bentham (B.Fl. vii, 598) describes the variety *setifer* in the following words :—

Spike, ovate or ovate-oblong, or cylindrical when young, ½ to ⅝ inch long.

Spikelets at length larger than in the typical form, the outer glumes ciliate with rigid hairs on the margins and back.

Habitat.—The type comes from Lofty Range, near Adelaide. The specimen drawn for the present plate was collected at Mount Victoria, New South Wales.

This form is represented in the National Herbarium, Sydney, from the following localities :—Blackheath, New South Wales (A. A. Hamilton); Wingello, New South Wales (J. L. Boorman); Grampians, Victoria (H. B. Williamson); Oulina, Western Australia (Max Koch).

Value for forage.—It is a small, harsh, dry grass, of very little value to the pastoralist, but it will grow in the bleakest and most sterile situations, and, therefore, has some merit in keeping such soils together.

EXPLANATION OF PLATE.

1. Entire plant.

1*a*. Leaf, showing the spreading hairs from which the variety takes its name.

2. Flowering spike, the spikelets spread out so as to show their attachment.

3. Outer glume, showing the venation.

4. The two persistent outer-glumes.

5. Flowering-glume and palea.

Trials of New South Wales Saltbush in Portugal.

In a letter offering to exchange seeds of fodder plants and grasses grown in Portugal, Professor Cabreira, of Polytechnic School, Lisbon, states that experiments are being undertaken with New South Wales saltbush on the alkaline plains of Portugal.

Several years ago saltbush was sown over large areas of desert country in the United States with most satisfactory results.

Government Stud Bulls available for service at State Farms, or for lease.

Breed.	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Dora's Boy ...	Cornish Boy ...	Lady Dora .	Cumbalum ...	17 Dec., '09.
,, ...	Pansy Duke ...	Earl March ...	Pansy 4th ...	Wollongbar Farm.	*
,, ...	March Pansy ...	Earl March ...	Australian Pansy	Grafton Farm ...	*
...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd.	Berry Farm ...	*
Jersey ...	Thessalian II ...	Thessalian ...	Egyptian Princess	Wollongbar Farm.	*
,, ...	Golden Lord ...	Golden King ...	Colleen ...	Wagga Exp. Farm	*
,, ..	Sir Jack ...	Omelette's Pride	Lady Tidy 3rd (imp.).	Berry Farm ...	*
,, ..	Berry Melbourne	Melbourne ...	Rum Omelette	Mt. Irvine, Bell ...	*
Guernsey ...	Gentle Prince ...	Rose Prince ...	Gentle ...	Alstonville ...	19 Jan., '10.
,, ...	Prince Edward..	Rose Prince ...	Vivid ...	Wyrallah	13 May, '10.
,, ...	Star Prince ...	Calm Prince ...	Vivid ...	Alstonville District	17 Dec., '09.
,, ...	Prince Souvia ...	Vivid's Prince...	Souvenir ...	Wollongbar Farm.	*
,,	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Paterson District	22 Oct., '09.
Red Poll ...	The Judge ...	Barrister ..	Lovely 8th ...	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General... ...	Judy 9th ...	Bathurst Farm ...	*
,, ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
,, ...	Auchenbrain Spicy Jock (imp).	Howie's Spicy Robin.	Another Mayflower	Berry Farm ...	*
,, ...	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
,, ..	Jamie's Ayr ..	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
,, ..	Emerald's Mischief.	Prince Emerald	Miss Prim ...	H.A. College, Richmond	*
,, ...	Dado	Daniel	Dot	H.A. College, Richmond	*
Kerry	Bratha's Boy ...	Aicme Chin ..	Bratha 4th ..	Glen Innes Farm...	†
,, ...	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Dexter Kerry	Waterville Punch.	....	.. ..	Grafton Farm ...	*
Holstein ...	Obbe II ..	Obbe	La Shrapnel...	Wollongbar Farm	*
,, ...	Hollander ..	Bosch III ..	Margaretha ...	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

Seasonable Notes.

WITH the view to providing for the guidance of all concerned in the production of crops, reliable information in a handy form as to the proper time not only to sow various crops, but also as to the proper time to make the land ready for sowing, the managers of the Experiment Farms have been invited to contribute data based on the results in each case of a prolonged experience of the local conditions of the district of which each farm is respectively typical.

It was hoped that the information would be ready for this issue of the *Gazette*, but it is found, on going carefully into the matter, that by making more numerous subdivisions of the State it will be possible to more definitely indicate the seasonal operations of respective districts. Opportunity will also be taken to add meteorological data as to averages and extremes of rainfall and of temperature over a long series of years, which may serve further to indicate the cropping possibilities of practically every portion of the State into which agricultural settlement has extended. The complete calendar will be issued also in the form of a Bulletin for easier reference.

Meanwhile, as the current month is a time in many districts when so much can be done to get land ready for lucerne, maize, sorghum, millet, leguminous crops, pumpkins, melons, a wide variety of vegetables, and for laying down pastures, the cultural directions for the month are reproduced in an abridged form without the specific subdivisions of districts which will be made in the complete calendar.

HAWKESBURY DISTRICT.

H. W. POTTS, Principal, Hawkesbury Agricultural College.

So far, the winter has been very mild, with few frosts and occasional showers, and we start the month of August with prospects of a good season ahead; in fact, better than we have enjoyed for several years past.

The cereal crops are in good order, with vigorous growth evidenced on all sides.

The soils are in fine order, and offer every encouragement to farming operations.

The main operations will be to prepare the ground for the early summer crops for green feed such as rape, millets, and maize.

The roots of maize, millets, and sorghums penetrate to a great depth for nourishment and moisture, hence the aim is to adopt deep cultivation in order to loosen the subsoils. A porous subsoil not only affords the roots an opportunity to develop, but also to provide storage for moisture.

All vegetable matter, weeds, stubble, and such like, should be turned in, not burned off.

Towards the end of the month the early crops of maize may be sown, and the best varieties for this district are Red Hogan, Early Mastodon, Hickory King, Calabash, Iowa Silvermine, Riley's Favourite, and Ninety Day.

The first crop of Hungarian millet for the season may also be sown, provided the prospects for an early spring be fairly assured. The millets are hardy, and a good growth is always found even under droughty conditions. They will thrive on a variety of soils, but, of course, do best on a rich loam.

White French millet is an excellent crop to clean foul land, and to get rid of weeds. Get the surface soil into fine condition, and use 7 lb. seed to the acre, sown broadcast.

Sorghums.

The first crop of this useful fodder may be sown in drills 3 feet apart to permit of shallow cultivation. Early Amber Cane or Planters' Friend are good sorts.

Rye.

The final crop of the season for green feed may be sown broadcast, 1 bushel to the acre. This will be fit for grazing off in November.

Rape.

The early spring crops of rape have not been successful. This was mainly due to the spring having been ushered in on the dry side, and the plants were not well nourished, with the result that cabbage moth and aphis attacked them. In a fairly moist season such as the present, this may be overcome.

A rape crop in spring provides a high-class fodder for sheep and pigs, and gets the soil in good order for late sowings of maize, sorghum, and millet.

Much depends on the sturdy and vigorous growth of the crop. So far, conditions are promising. In any case, it will be well to put in small areas for the pigs. Dwarf Essex is the best variety; sow 4 lb. seed to the acre broadcast. To stimulate early growth, apply 1 cwt. of superphosphate to the acre.

Lucerne.

Where the land has been thoroughly cleansed and freed from weeds by a final crop of barley or fallowing, the early spring sowing of lucerne may be made now. The spring-sown crops, as a rule, do not germinate and flourish so well as those sown in autumn. The present season, however, is under better conditions for moisture, and points to a favourable growth.

Potatoes.

The main crop can be put in towards the end of the month, provided the possibility of severe frosts is past.

It will be important this year to exercise great caution in purchasing seed potatoes free from disease. The red and brown-skin varieties do best in this district. Bliss's Triumph, Brownell's Beauty, Early Rose, Satisfaction, Imperator, Manhattan, Centennial, and Royalty are suitable sorts.

In the absence of a sufficiency of farmyard manure, the following may be substituted per acre:—

2 cwt. Superphosphate. 1 cwt. Sulphate Potash.
1 cwt. Dried Blood.

In preparing the soil, thorough cultivation should be followed, and care taken to incorporate the manures so that the sets will not come into direct contact with them.

Sweet Potatoes.

It is now necessary to raise suckers for planting, and to this end a forcing-bed is prepared with horse manure 2 feet deep, covered with 4 inches of sharp sand. The situation should be warm and sheltered. Surround the bed with a rough frame in order to throw over a covering of bagging or hessian to protect the young plants from frost. The tubers are bedded closely together, but not touching, and then covered lightly with sand. During the daytime, when the sun is available, the hessian covers may be removed from the frame. As soon as this sprouting is well forward, and the shoots 6 or 7 inches long, they are fit for transplanting into the field about the middle of October.

Roots.

Field carrots, parsnips, mangolds, and sugar beets can have attention now. These require to be well worked at least 12 inches deep. The mangold is a gross feeder, and requires a rich soil or ample manuring, especially organic, such as farmyard manure.

Onions.

The first sowings of the season may be made after obtaining a clean, well-worked soil, and a very fine surface. Brown Spanish, Early Brown, Globe, Silver King, and James Keeping Onion are recommended.

South Coast.

P. QUIRK, Manager, Berry Stud Farm.

Land should be prepared for sowing grasses, potatoes, maize, sorghum, millet, pumpkins and melons. The soil should be broken up roughly as early in the month as possible, so that the frost may destroy a large proportion of couch and other troublesome growths and mellow the soil.

For green fodder, to come on before maize and sorghum are ready, small patches of rye, oats, or rape may be sown this month.

If there is a naturally well drained area available for lucerne, and one can be sure that it is pretty clear of weeds, lucerne can be sown at the end of August. If the area is known to be full of weed seeds it would be better to break it up roughly in August and wait until the weeds show up, when they can be destroyed, and so give the lucerne a chance to get a start without being strangled at the outset. The same remarks apply to onions.

During August is a good time to plant out asparagus, rhubarb, and artichokes. Sweet potatoes will do well in some parts of the South Coast districts where the soil is sandy, and tubers can now be set in sheltered corners or boxes to raise cuttings for planting out when all danger of frosts is passed. Peas can be sown, and in sheltered situations beans also. Cabbages,

carrots, turnips, and celery can be sown freely, but care must be taken not to plant them in immediate contact with fresh manure. It is better to work the manure into the soil in advance of sowing.

Central Tableland District.

R. W. PEACOCK, Manager, Bathurst Experiment Farm.

Oats, rye, field-peas, tares, kale and cattle cabbage, and grasses may be sown during this month. Lucerne may be sown on well-prepared clean land if moisture has been conserved; but unless the soil is in perfect order, spring sown lucerne in this district is risky. Stock should be taken off lucerne paddocks and the surface loosened by use of a spiked roller or harrow, so as to give the crop a fresh start.

In the vegetable garden, sow carrots, parsnips, turnips, broad beans, peas, lettuce, beet, and radish. Sow in seed beds cabbage, Brussels sprouts, early cauliflower, tomatoes, and capsicums. Transplant asparagus, rhubarb, cabbage, lettuce, early cauliflower, and eschalots.

Cowra District.

G. L. SUTTON, Cowra Experiment Farm.

No time should be lost in the preparation of land for potatoes, maize, millet, sorghum, and cowpeas, which are to be planted in September. There is every advantage to be gained by having the soil opened to receive any rain that may fall a few weeks previous to sowing; and as none of the crops enumerated are grown in very extensive areas, it will not be a difficult matter to scarify the soil if unfavourable weather is experienced during the time it is idle.

This is the time of the year to turn under green manure crops if any should be available.

The opportunity might also be taken to plant out evergreen trees for shade and shelter.

Riverina District.

G. M. McKEOWN, Manager, Experiment Farm, Wagga.

Get land ready for millets, sorghum, maize, sweet potatoes, pumpkins, melons, sugar beets, mangolds, and other small patches of spring crops for pig, sheep, or cattle fodder. Plough land to lie fallow for wheat, barley, and oats, to be sown next autumn.

Roots of grasses can be transplanted, and where the soil has been well prepared sow lucerne.

Orchard Notes.

W. J. ALLEN.

AUGUST.

Planting.

THE planting of deciduous trees should be completed as early as possible this month. The earlier a tree is planted in the winter the better it usually does should the spring prove a dry one. The later planted trees will in all probability make a much weaker start than those planted in the earlier winter.

Pruning.

This work should be completed this month, care being taken to see that the limbs are evenly spaced, and due regard should be given each variety in order that they may be pruned in such a manner as will ensure them giving the best results. For instance, some apples throw out a profusion of short spurs while others carry their fruit on quite long spurs. Again, some peach-trees are furnished with good fruiting buds from base to terminal, buds of all new growth, while others will be found to carry but few, if any, such buds near the base of such growth. Again, some apricot-trees carry a wealth of good spurs and twigs throughout the tree, while on other varieties the buds and good fruiting spurs are conspicuous by their absence; in the latter case it would be as well to either work the tree to some better variety or uproot and replant with other better varieties, as there is very little use in giving such a tree room if it is not productive after it is three years old.

Spraying.

The winter spraying may be commenced towards the end of the month. The following are a few of the enemies which we have to try and keep down by the use of the spray pump, viz.:—Red Mite, Mussell Scale, San José Scale, Woolly Aphis, Black Aphis, Peach Curl, Anthracnose and Shot Hole Fungus, and some of the best sprays for use are Bordeaux Mixture for many of the fungus diseases; lime and sulphur wash and red oil emulsion for scales, mites, &c. The resin and soda wash and also Sunlight soap are good for the different aphides.

Leaflets containing full directions for preparation of sprays may be had, free, on application to the Under Secretary, Department of Agriculture.

Codlin Moth.

All bark should be scraped from apple, pear, and quince trees and the scrapings burnt, and everything in the orchard which would be a harbour for Codlin Moth destroyed. Keep all fruit-houses as clean as possible, as there is no doubt that they are responsible for harbouring a great many moths every year. Therefore, keep the rooms as airtight as possible, and as soon as the moths begin to hatch in the spring, burn sulphur in the rooms once every other day for a fortnight, so that the moths as they begin to fly may be destroyed by the fumes.

Vine Moth.

In working around vines, keep a sharp lookout for the pupæ of the vine moth. If there are any old, partially-rotted stakes, the moths will be found adhering to these and also to the old bark which is hanging to the vine. Destroy these wherever found and thus assist in keeping down the pest as far as possible.

Commercial Manures.

These may be applied towards the latter end of the month or in September. In the drier districts where late rains are uncertain, it is better to make the application early rather than late, as it is well known that they do not give the same results if applied when the soil is at all dry. If summer applications are made it is better to make them immediately after a rain while the ground is quite moist, in order to obtain the best results.

Bulletin No. 17 containing directions for the manuring of different kinds of fruit-trees and cost, may be had, free, on application to this Department.

Almonds.

Hatch's Nonpareil, California Paper-shell, and Brand's Jordan are said to be three of the best varieties of these nuts growing in South Australia. In California Ne Plus Ultra, Nonpareil, I.X.L, and Jordan are said to be among the best growing there.

White Ants and Fruit-trees.

In many districts white ants are very destructive to young fruit-trees.

The Entomologist advises that every particle of dead wood, stumps, or roots should be cleared out of the ground in which the fruit-trees are planted, and the soil well broken up. If, when planting young trees, the roots and portions of the stem that are covered with soil are dipped into a bucket of water in which a tablespoonful of Stockholm tar has been dissolved, this will keep the white ants away for some time after planting. The tar can best be mixed with the water by letting it drip into a gallon of hot water (do not do this while the vessel is on the fire).

To drive white ants out of the soil, dig in around the tree from ½ lb. to 1 lb. of kainit (German potash). This will keep them away for some time, but will have to be renewed if the white ants are numerous, or there is, in old stumps or roots in the vicinity of the trees, a safe harbour for them.

Where the attack is made in the trunks or branches, holes should be opened into them (if the latter cannot be cut off), so that the light and air can penetrate. Ants thus disturbed will leave the exposed parts, and all the scars on the wood of the tree should then be carefully dressed with paint or Stockholm tar to prevent fresh attack.

Mr. C. McDonald, of Killarney, Peak Hill, who tried this plan, reports that he has quite succeeded in getting rid of the white ants from his orchard, where they had proved extremely destructive.

Co-operative Organisations of Fruit-growers.

A special Bulletin, No. 26, giving full details of co-operative organisations of fruit-growers in America, is now available, free, on application to the Under Secretary, Department of Agriculture, Sydney.

Investigation of Black Spot in Citrus Fruits.

In view of the losses sustained by citrus growers through the presence of the disease *Phoma citricarpa*, commonly called Black Spot, arrangements were made for the Fruit Expert to carry out, in conjunction with Mr. Harvey Johnston, of the Bureau of Microbiology, experiments to determine the most effectual preventive treatment.

The experiments are now in progress at Mr. S. Moore's orchard at Dural, and Messrs. Jenkins Bros.' Orchard at Lisarow.

The plan of the experiments in the two orchards will be as under :—

	Dates of spraying.
One spraying with Ammonia-carbonate of copper.	1st October.
Check.	
Two sprayings, Ammonia-carbonate of copper.	1st September, 1st October.
Check.	
One spraying, Bordeaux mixture.	1st September.
Check.	
Two sprayings, Bordeaux mixture.	1st and 21st September.
Check.	
Three sprayings, Bordeaux mixture.	15th August, 1st and 21st September.
Check.	
Three sprayings, Bordeaux mixture One spraying, ammonia-carb. of copper.	15th August, 1st and 21st September, 14th October.
Check.	
Three trees treated with sulphate of iron.	1st June.

In addition to these trials, arrangements have been made for a series of tests to determine the single spray which will prove effective in order to combat the pest most economically.

Trials of Grasses.

In October last, the Superintendent of School Gardens, Colombo, forwarded in exchange for some *Phalaris commuta* seed sent him, a quantity of seed of Guinea grass (*Panicum maximum*) from the hilly country of Ceylon.

As the strain of Guinea grass hitherto tried in New South Wales has proved to be of rather indifferent value, on account of its coarse habit of growth, every effort was made to give this fresh strain a fair test in order to determine its suitability for our conditions.

The Experimentalist at the Hawkesbury Agricultural College, Mr. A. H. E. McDonald, reports: "The seed was planted in a seed bed on 16th October, and the seedlings were transplanted into rather poor sandy soil on 8th December, 1908. For comparison, common Guinea grass was grown also in the same way and at the same time. A sufficient period has not yet elapsed to warrant a decisive report being made as to the influence of winter weather upon the Ceylon strain. So far, it has thrived comparatively well. It has made a more vigorous growth than the common Guinea grass, and has grown to a height of 2 feet 6 inches. It came into head on 1st April, and in three weeks began to form seed. This was much earlier than the common Guinea grass, which, up to the end of April, had not come into head. The Ceylon strain is rather finer in the stem and leaf, and appears to resist drought better. It has done well on poor sandy soil. It seems a little too coarse in both stem and leaf to make a good pasture grass, but should be very suitable for second-class country.

At Wollongbar Experiment Farm, the seed was sown 16th October, 1908; it germinated poorly, grew slowly, and came into head 27th April, 1909.

Mr. Alexander considers that this strain is heavier in the stem, but shorter in growth than the Guinea grass that has been established many years in the district, but it is identical in every other respect.

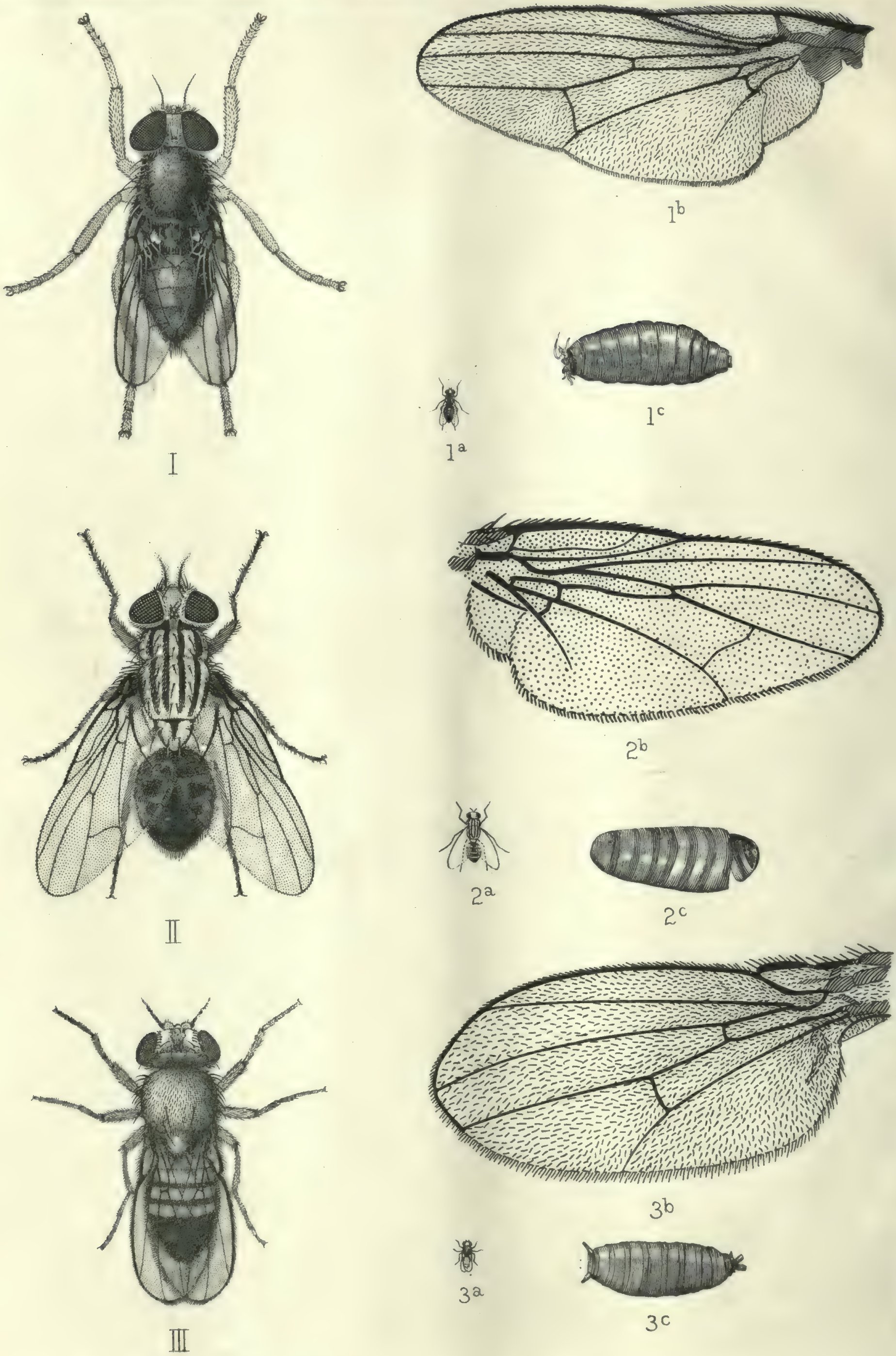
At the Grafton Farm, the seed was sown in drills on 18th November, 1908, and made a very vigorous growth, and by the middle of April had reached a height of 3 feet. By the first week in July it had reached a height of 6 feet 3 inches, and seeded.

Mr. Haywood found it hard to distinguish any difference between this Ceylon strain and the previously established Guinea grass. He is of opinion that the two strains are identical.

Scale Insects infesting Coffee Trees.

Some coffee trees growing at Tuggerah Lakes have been found to be infested with black or olive scale (*Lecanium oleæ*) which attacks citrus trees and other evergreens.

The scales in this case were found on the leaves and fruits. The trouble is a common one with coffee trees, which are particularly subject to scale insects. In Ceylon, where the coffee industry is of considerable extent, no less than four species of the *Lecanium* genus are found on the trees. The most effective spray for this pest is resin wash.



ORIGINAL, DRAWN. FOR THE AGRICULTURAL GAZETTE.

SO-CALLED FRUIT FLIES THAT ARE NOT FRUIT FLIES.

So-called Fruit-flies that are not Fruit-flies.

In the May issue, Mr. Froggatt described a number of so-called fruit-flies, which are now illustrated in the accompanying plate.

Fig. I. Metallic-green Tomato Fly (*Lonchœa splendida*), which attacks tomatoes when damaged.

1a, the fly, natural size; 1b, wing; 1c, pupa.

Fig. II. The Green-bodied Fly (*Phaonia personata*), which infests decaying fruit.

2a, the fly, natural size; 2b, wing; 2c, pupa.

Fig. III. The Wine Fly (*Drosophila obscura*), which swarms about decaying fruit, wine stains, and even vinegar exposed to the air.

3a, the fly, natural size; 3b, wing; 3c, pupa.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1909.

Society.	Secretary.	Date.
Narrandera P. and A. Association	W. T. Lynch	Aug. 4, 5
National A. and I. Association of Queensland	C. A. Arvier	,, 7 to 21
Royal Agricultural Society (Sydney), Horse Parade and Dairy Cattle Show.	H. M. Somer	,, 8, 9
Urana P. and A. Society	J. Wise	,, 10, 11
Corowa P., A., and H. Association	J. D. Fraser	,, 17, 18
Forbes P., A., and H. Association	H. J. Brooke	,, 18, 19
Gunnedah P., A., and H. Association	M. C. Tweedie	,, 24, 25, 26
Murrumbidgee P. and A. Association, Wagga Wagga	A. F. D. White	,, 24, 25, 26
Parkes P., A., and H. Association	G. W. Seaborn	,, 25, 26
Northern A. Association, Singleton	F. A. Bennett	,, 25, 26, 27
Grenfell P., A., and H. Association	Geo. Cousins	,, 31, Sept. 1
Barmedman Ploughing Carnival and Horse Parade Society.	P. H. Sheahan	Sept. 1
Junee P., A., and H. Association	T. C. Humphrys	,, 1, 2
Lockhart A. and P. Society	H. Parnaby	,, 7, 8
Young P. and A. Association	G. S. Whiteman	,, 7, 8, 9
Cudal A. and P. Society	P. Gavin	,, 8
Ariah Park A., H., and I. Association	A. T. White	,, 8
Germanton P. and A. Society	James S. Stewart	,, 8, 9

Society.	Secretary.	Date.
Cootamundra A., P., H., and I. Association	W. E. Williams ...	Sept. 14, 15
Cowra P., A., and H. Association	J. T. Martin ...	,, 14, 15
Albury and Border P., A., and H. Society	W. I. Johnson ...	,, 14, 15, 16
Canowindra P., A., and H. Association	J. J. Finn ...	,, 21, 22
Moama A. and P. Association	J. C. Smith ...	,, 22
Burrowa P., A., and H. Association	W. Burns... ...	,, 22, 23
Temora P., A., H., and I. Association	John Clark ...	,, 21, 22, 23
Henty P. and A. Society	P. H. Paech ...	,, 28, 29
Wyalong District P., A., H., and I. Association ...	Thos. A. Smith ...	,, 28, 29
Millthorpe A. and P. Association	C. H. Shepherd ...	,, 28, 29
Ganmain A. and P. Association	A. R. Bolton ...	,, 29
Adelong P. and A. Association...	A. W. Molineaux..	Oct. 5, 6
Menindie P. and A. Association	L. E. Underdown..	,, 13, 14
Horticultural Society of N.S.W. (Sydney)	A. W. B. Bradley	,, 21
Lismore A. and I. Society	T. M. Hewitt ...	Nov. 17, 18, 19
Tweed and Brunswick A. Society	F. A. Wildash ...	,, 24, 25
Berry Agricultural Association...	C. W. Osborne ...	Dec. 8, 9, 10

1910.

Albion Park A. and H. Society...	Hector G. Fraser	Jan. 19, 20
Kiama A. Association	R. Somerville ...	,, 26, 27
Wollongong A., H., and I. Association	F. W. Phillpotts	Feb. 3, 4, 5
Shoalhaven A. and H. Association, Nowra	Henry C. Raneb...	,, 9, 10
Coramba District P., A., and H. Society	H. E. Hindmarsh.	,, 16, 17
Alstonville A. Society	W. Monaghan ...	,, 16, 17, 18
Guyra P., A., and H. Association	P. N. Stevenson ...	,, 22, 23
Tumut A. and P. Society	E. H. Vyner ...	,, 23, 24
Bellinger River A. Association	S. S. Hindmarsh...	,, 23, 24, 25
Gunning P., A., and I. Society...	W. T. Plumb ...	,, 24, 25
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Agricultural Gazette of New South Wales.

Bacon Curing.

H. W. POTTS, Principal, Hawkesbury Agricultural College.

IN curing pork for bacon, we have the knowledge that this class of flesh is specially adapted to salting and smoking, by which its digestibility and wholesomeness are increased rather than diminished as is the case with beef and other meats. The granular form of fat in bacon is easy of digestion, and can be eaten by most persons to whom any other fat is intolerable. Hence bacon is frequently used for delicate children, and where the free use of fatty foods is indicated for persons suffering from wasting diseases or requiring readily digestible fatty articles of diet.

It has been determined as a result of ages of experience as well as scientific investigation, that the use of salt in preserving food has no appreciable influence on health other than favourable.

Salting is one of the oldest methods known of preserving meat for man's use.

Salt acts as a dehydrating agent on flesh; in other words, it removes water retained in the tissues of the animal body. It is also mildly antiseptic in its action, and in this way assists to preserve.

The flesh of the pig does not absorb or take up salt so readily as other meats, owing to the large proportion of fat to lean.

The length of time pigs' flesh should be submitted to the influence of salting depends on various conditions.

Some breeds of pigs give a greater proportion of fat. The absorption of salt in this case is slower.

The size, thickness, age, and weight of the flitches and hams have to be considered.

It requires less time to cure in a damp cellar than in a dry room.

The extremes of heat and cold are unfavourable. In the former case, flesh is liable to decompose before the salt permeates it sufficiently to cure it.

Where subject to an excessively low temperature, the meat juices become set and the flesh too firm for the salt to penetrate.

Temperature of Cooling Room.

It should be noted that the temperature of the curing room should never exceed 60° Fahr. Precautions should be observed to have the tables and room in which curing is conducted scrupulously clean, free from dust, and with a sweet atmosphere.

Salting.

It was at one time deemed good practice to rub the flesh briskly every day, but it is generally found that this is only necessary for the first three days. The salt mixture only requires to be spread over the flesh firmly.

An exception may be made in the case of large thick pieces or where the flesh is very cold ; then brisk rubbing is an advantage.

The salt should be pressed into every depression and well into the hock ends where the feet have been cut off, and into the joints.

To continue the hard rubbing too long results in a hardened cured flesh.

Brown sugar is used in varying quantities with salt, in order to correct the hardening influence of salt on the meat. It also renders the bacon mellow, and increases its juiciness and flavour.

Sugar may also be classified amongst the mild antiseptics as a meat preserver.

The Purpose of Saltpetre.

Saltpetre, also known as nitre, or potassium nitrate, is used in curing. It possesses antiseptic properties, but it is chiefly added to preserve the natural colour of the flesh. When salt is used alone, the natural flesh colour fades and lessens the attractiveness of the bacon. Attention must be given to the quantity used, as it has the effect of unduly toughening the meat if applied in excess. The quantity should not be more than 1 part to 25 parts of salt.

All ingredients used in the mixtures applied for curing should be of the best quality, and thoroughly mixed.

Flavouring Agents.

Flavouring agents of a harmless nature are frequently used, and may be selected from the following :—Cayenne pepper, white and black pepper, nutmegs, corianders, garlic, juniper berries, bay leaves, allspice, ginger, sage, cloves, cinnamon, bruised shallots, thyme, mace, marjoram, mustard.

To Fix Colour.

Immediately after cutting up and trimming, the surface of the flesh should be sprinkled over with equal parts of finely-ground salt and saltpetre.

This is best effected through a muslin bag or a horse-hair sieve.

Only a small layer is required. This is allowed to remain for twenty-four hours, and washed off with clean, cold water.

It acts as a mordant, to fix or render permanent the natural colour of the meat.

Curing

Can be conducted in several ways.

It must again be urged that each operation should be conducted under rigid conditions of cleanliness in a cool, sweet atmosphere, with a temperature not exceeding 60° F.

Pickling.

Numerous recipes are available for pickling bacon. The following is recommended :—

Clean rain water	20 gallons.
Fine dairy salt	50 lb.
Brown sugar	5 lb.
Saltpetre	2 lb.
Allspice	½ lb.

Dissolve the salt, sugar, and saltpetre in the water. Immerse the allspice, tied up in a calico bag. Boil for one hour, and skim off the frothy matter rising to the surface whilst boiling. Allow this solution to cool before filling the pickling vat, barrel, or tub. This is sufficient for 500 lb. of meat. The sides should be rubbed with salt for two days before being immersed in the pickle. It may be necessary to place sufficient weights on the sides to keep them immersed. The time in pickle will be determined by the size of the sides, but it is usually three weeks.

Dry Curing.

This recipe has given good results :—

Fine dairy salt	50 lb.
Brown sugar	5 lb.
Saltpetre (finely ground)	2 lb.

Mix well.

For the first three or four days this mixture should be rubbed in over the flesh parts and around the bones and joints. Afterwards spread the mixture freely each day. The sides should be stacked. Alternate the method of stacking, so that the side on the top one day will be at the bottom the following day. Time required, about fourteen days, according to size of side.

Where a sweet, juicy, mild-cured bacon is required, the following may be used instead of the foregoing :—

Sugar and fine dairy salt, equal parts. Mix well.

To impart a distinctive flavour, this famous French recipe is given :—

Fine dairy salt	6 lb.
Brown sugar	6 lb.
Allspice	1 lb.
Mustard	1 lb.
Saltpetre	1 oz.
Bicarbonate of soda	1 oz.

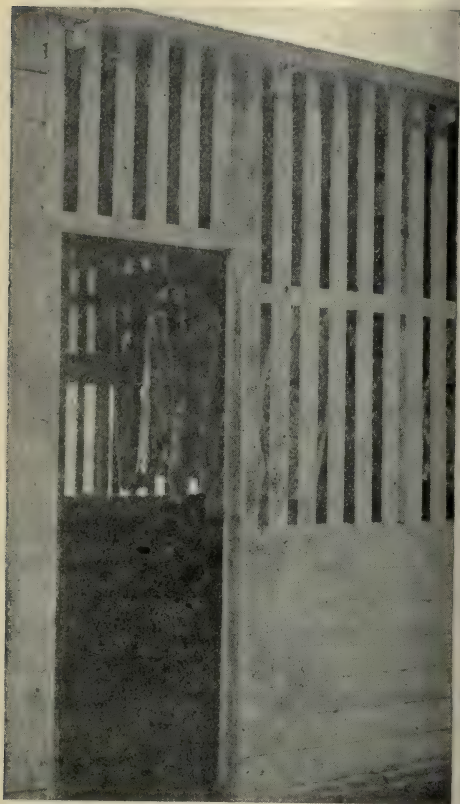
Mix well.

Rub over the flesh daily for three days, and afterwards spread on each day for seventeen days, turning the sides in rotation.

Washing.

On removal from the pickle, or at the conclusion of the dry-salting, the side must be prepared for smoking. The flesh is brushed over with a dandy brush to remove salt, pieces of fat and flesh, and cleaned up. The side is washed in rain-water and soaked in a solution of bicarbonate of soda for twenty-four hours. The solution is made by dissolving 1 lb. of bicarbonate of soda in 20 gallons of clean rain-water. This removes excessive saltiness and makes the curing milder. Follow this by washing in clean rain-water.

The meat edges and bones are trimmed again. All sharp points of bones and loose or hanging pieces of meat are removed, leaving the side neat and shapely.



The Drying Room at Hawkesbury Agricultural College.

Hang the side up to dry in a room, free from dust and insects, with a full current of air for several days. Then lightly rub olive oil over the skin and flesh.

It is now ready for smoking.

Smoking.

In addition to the preserving action of smoke it imparts a relishable flavour which adds to the value of the bacon.

The process of smoking preserves flesh by coagulating the albumen near the surface and forming a protective covering or envelope.

It has been ascertained that in smoking bacon there is no loss of nutriment, and it is as digestible as fresh meat.

The smoke creates a distinct antiseptic or preservative action apart from the dried albuminoid coating by depositing on the surface from the smoke creosote, formaldehyde, and pyroligneous or crude acetic acid. These check the action and growth of putrefactive organisms and their processes. They retard decomposition, as well as imparting a delicate and appetising flavour.

The smoke house should be about 12 feet high, seeing the bacon must be hung from 6 to 10 feet from the floor.

The floor should be earthen, brick, or cement, with a depression in the centre, away from the walls, in order to avoid setting fire to the frames.

There should be no light, excepting that admitted from the door when open. Sunlight has a tendency to bleach the bacon and deprive it of its natural colour.

Whatever ventilation is provided, and some is needed, it should be under control. The aim is to surround the bacon with a dense atmosphere of smoke at a low temperature.

Many methods of creating a proper class of smoke are applicable. White pine, oak, cedar, or hardwood sawdust, with damp corncobs and a few green eucalyptus leaves will answer from which to kindle a fire with a good development of smoke without much heat; or sprinkle essence of smoke (pyroligneous acid or crude acetic acid) over the smouldering sawdust.

The Smoke House at Hawkesbury Agricultural College.

In case of direct heat reaching the bacon hanging over the fire, this can be avoided by having a sheet of galvanized iron placed a few feet over the fire, supported on loose bricks.

The smoke must be conveyed to the bacon as cool as it can be. To do this, care must be exercised in preventing direct heat reaching the bacon.

In deciding the length of time to apply smoke, judgment must be used. The desirable colour is a light brown tan. To obtain this, smoking may occupy any period from thirty-six hours to five days.

The character of the flesh, its thickness, and other characteristics must be estimated in order to obtain perfection in determining the colour and flavour imparted by smoking.

Finish the sides now by dressing and rubbing the skin and flesh with pure olive oil.

Smoked bacon will hang well in the smoke-house until required, provided reasonable care be taken to exclude insects and keep the smoke-house dark, dry, and cool.

Any degree of dampness or moisture in the atmosphere in which the bacon hangs will end in mouldy bacon.

Where it is proposed to pack the bacon or ham in order to preserve it against attacks from insects or other troubles, the flesh is rolled in bran,

oatmeal, shelled oats, or pea-meal, wrapped in newspapers, and stowed away on shelves or in boxes.

Every effort should be made to prevent blow-flies and other pests getting access to the surface of the meat. They leave eggs on the flesh and in its numerous interstices; later on these give endless trouble. A simple means of checking their depredations is to sprinkle the surface of the meat with black pepper or a mixture containing this and cayenne pepper.

Another effective plan is to saturate calico hessian, or clean bagging, in a creamy mixture of lime and water, and wrap the ham or bacon previously rolled in oat or pea-meal. Stitch the covering closely round the flesh.

FESTUCA ELATIOR.—A GRASS SAID TO BE WORTHY OF ATTENTION.

MR. E SECCOMBE forwards correspondence in respect to a grass, *Festuca elatior*, which he is of opinion would be suitable for the South Coast districts. He adds that Mr. H. Baun, of Palma, Shoalhaven, has a small area of this season's sowing under test, and that Mr. C. McLean, of Yattah, Milton, has also an acre or two of this grass under trial. Mr. J. Kennedy, of Comerong Island, and other farmers, are also trying this grass.

Mr. Geo. Valder, Chief Inspector, reports: "*Festuca elatior* is an old and well-known grass. It has been experimented with for many years past by the Department at the various Experiment Farms, and seed has been distributed to applicants, up till lately, however, without any specially good results.

"In September, 1904, a number of grass plots were sown by Mr. Dunnicliffe, of the Department of Agriculture, on a piece of land belonging to Mr. W. D. Warden, of Milton, which had been lent to the Ulladulla Agricultural Association for purposes of experiments.

"When inspecting this area in July last year, my attention was drawn to the fact that, although most of the grasses sown by Mr. Dunnicliffe had died out (either by being choked by couch or by dry weather), there was one grass which had stood better than any of the others. This grass had spread from its plot and could not be identified as it was not in flower or seed. I instructed Mr. Makin, however, to watch this grass and, if possible, send up specimens when it was in flower. This he did, and it was identified by Mr. Maiden as *Festuca elatior*.

"As there was some doubt about the value of this grass, I told Mr. Makin to arrange for further trials, and arrangements were made for putting in two ½-acre plots—one at Berry and one at Milton, and the seed was sown a few months ago.

"The seed can be obtained from any seedman. I do not think that the Sydney seedmen have catalogued it for some years past, as there was no demand for the seed, but the Melbourne and Adelaide seedmen always catalogue it."

It might be added that in describing and illustrating *Festuca elatior* (Tall Fescue) in his work, *Permanent and Temporary Pastures* (England), Mr. Martin J. Sutton makes special reference to the liability of this grass to the attack of ergot, and some of the authorities he quotes emphasise this point, and states that in consequence of this liability it is rarely, in Great Britain, that the grass produces fertile seed.

Some Practical Notes on Forestry suitable for New South Wales

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

XX.

WILLOWS AND POPLARS.

With special reference to Osier Culture for basket and furniture making.

WE have now come to the family Salicaceæ, containing the Willows (*Salix*) and Poplars (*Populus*). This family is not represented in Australia by any indigenous plants, but many Willows and Poplars do remarkably well in various parts of New South Wales.

The genus *Salix* includes over 160 species, chiefly in the Northern Hemisphere, but a few extend to Chili in South America. There are nearly 70 species in the United States, America, twenty of which are trees.

In Europe no less than 92 varieties hybrids of *Salix* are cultivated for economic purposes (chiefly for basket-making).

Flowers and fruit do not play much part in the classification of *Salix*; the leaves are important for this purpose. The character of the stipules, the mode of growth, and the serration and pubescence and shape of the leaves are the only guides available; but these are by no means so useful as might be supposed, since they vary according to circumstances, the shape of the stipules being alone the best indication of the species. Stipules, however, are not always present.

In other words, the discrimination of members of the genus *Salix* is the work of the specialist.

Besides the names given by botanists on grounds more or less defensible, there is a perplexing collection of names given by horticulturists. They look like botanical names, but they are not, and the chief result of their use is to give everybody who looks into them a great amount of trouble, and sometimes to cause the buyer of plants or cuttings to think he is getting something new.

Species of *Salix* are termed (a) Willows, (b) Osiers, (c) Sallows.

(a) The term *Willow* is generally applied to the species that form trees, even when they are pollarded close to the ground, and grown as shoots or osiers, 6 to 9 feet long.

(b) The name *Osier* is in England mainly applied to forms and hybrids of the species *Salix viminalis*, which grow readily into long rods or shoots almost without lateral branches. The true Osiers are chiefly used for hampers and brown wicker work, and are not usually peeled.

In the United States the name Osier seems to be used more broadly than in England, and to include any species or variety used for basket-making.

(c) The term *Sallow* is given to Willows that have a shrubby growth, and more or less broad downy leaves.

Sallows are chiefly of botanical interest, so far as we are concerned. The name Sallow or Sally is incidentally of interest to us in New South Wales, since the early colonists likened certain Wattles and Gums to them.

Willows and Osiers are chiefly valuable in this country, at the present time, for decorative (chiefly waterside) planting, and for the protection of river banks and of hill sides. They are destined to be utilised enormously for protective planting in New South Wales. The work is of national importance.

As a community, we are users of boxes rather than baskets for merchandise and other purposes, but there is no doubt that a demand for Osiers could be created in time, particularly in regard to agricultural produce.

For our fruit we use the split Mountain Ash case-timber of Tasmania and the sawn timber cases of the mainland. Baskets for fruit, provided they are sufficiently rigid, are lighter and ventilate the fruit better than do wooden cases.

Willows are all more or less valuable to the bee-keeper.

The bark of many species is rich in Salicin (from which the pharmaceutical chemist prepares many preparations used by the physician in the treatment of rheumatism), but no experiments appear to have been made on the relative value of Australian grown trees and shrubs of this genus in regard to the percentage of this substance.

What we want to do is to grow more Willows, and of as many varieties as possible, and thus become accustomed to the merits of the various kinds in each district, and thus first use them and then extend their use. Speaking generally, Willows and Osiers prefer the colder districts of the State, moist situations, and (many of them) good soil. For example, the Willow family grows splendidly at Tumut. But there are thousands, aye, tens of thousands of places in this State where Willows will grow as well as in any part of the world.

Some Bibliographical References.

1. Report of the Secretary for Agriculture of the United States, Division of Forestry, 1886, "Osier Willow Culture," p. 223; also 1889 "Osier Culture" pp. 285–289.

The experiments of importing cuttings of a large number of European species was partly a failure, because of the warmer, sunnier, more droughty conditions of the summer of a large part of the United States, America, where they were tested. No doubt a somewhat similar experience would result here. They could not be expected to succeed, for example, in the Western Plains, but even there I believe certain varieties (yet to be ascertained) will be found to do well in selected localities.

2. "Osier Culture" by John M. Simpson, Bulletin No. 19 of the United States Department of Agriculture, pp. 27 (1898).

3. "The basket Willow" by William F. Hubbard, with a chapter on "Insects injurious to the Basket Willow," by F. R. Chittenden, Bulletin No. 46, pp. 100 (1904).
4. "Practical results in Basket Willow culture," by C. D. Mill. Circular No. 148, pp. 7 (1908).

This circular contains an account of Osier cultivation by the Department on its own farm at Arlington, Virginia.

(These three publications are of great value chiefly from the point of view of cultivation and preparation of the Osiers for market.)

5. "Willows used in Pharmacy," by E. M. Holmes. *Pharm. Journ.*, 1st August, 1903, p. 145 (contains valuable notes on classification).
6. Mueller's "Select Extra-tropical Plants."
7. Kew Hand-list of Trees and Shrubs (excluding Coniferæ), grown in the Arboretum. (2nd edition, 1902.)
8. Sargent's "Silva of North America." (Vol. ix.)
9. "A Revision of the British Willows," by F. Buchanan White. *Journ. Linn. Soc.*, xxvii (1890).
10. "Variations in the occurrence of Salicin and Salinigrin in different Willow and Poplar Barks"; by H. A. D. Jowitt and C. E. Potter (Wellcome Chemical Research Laboratory Bulletin No. 28, 1902).
11. "Comparative Anatomy of the Barks of the Salicaceæ"; by P. E. F. Perrédès (*ib.* Bulletin No. 39, 1903). Contains excellent anatomical drawings.

I have used the above works more or less (especially Sargent) in the compilation of these notes.

WILLOWS.

(*S. alba*, *S. daphnoides*, and *S. fragilis* are, perhaps, the most valuable timber trees of the genus).

1. *S. alba*, L. The "White Willow." Figured in *Eng. Bot.*, ed. 3, t. 1309.

A noble tree, often 80 feet in height, with a trunk frequently 3 or 4 feet in diameter. It is widely distributed in many forms through Europe, from Southern Scandinavia to the shores of the Mediterranean, and through Siberia, Western Asia, and Northern Africa. Abundantly acclimatised in Eastern North America.

Timber used for the rafters of buildings, for the lining of carts used in the transportation of stone, in turnery and cooperage, and the charcoal used in the manufacture of gunpowder. It is also used for making wooden legs, and for chip boxes used in pharmacy.

It is sometimes used in the manufacture of cricket bats, though not of the best quality.

The leaves form excellent fodder for domestic animals. Bark used for tanning leather, and in medicine.

It prefers a moist, rich sandy loam of alluvial origin and banks of streams. It is sufficiently hardy to grow on the dry prairies of the Dakotas (U.S.A.),

but its growth on upland situations is considerably slower than when planted in the bottom lands. In the United States the caution is given not to plant it along irrigation ditches.

[See Forest Planting Leaflet (Circular 87) of the Forest Service of the United States, which deals solely with this tree.]

*L 15 a—Sydney Botanic Gardens.

1A. *S. alba*, L., var. *cœrulea,* Syme (*S. cœrulea*, Sm.). A "Close-bark Willow."

An article of interest to Australians is "The Cricket-bat Willow," by W. J. Bean, in the *Kew Bulletin*, No. 8, of 1907. It is there pointed out how very great is the demand for willow which yields the best material for cricket bats. One firm offered £40 for a single tree, whilst £1,500 was refused by a certain Essex estate for the best 100 willows on that property. In consequence, an impetus has been given to the cultivation of the best willows for that purpose, and there is no reason why New South Wales should not supply good material.

Mr. Bean says, "The identity of the true 'Bat Willow' has always been obscure. The cricket bat maker recognises the tree best suited to his purpose with infallible certainty, but the characters on which he relies are not characters on which the botanist bases his distinctions."

With the assistance of John Shaw, of the great English firm of cricket-bat manufacturers, and Rev. E. F. Linton, M.A., a well-known English botanical specialist in Willows, it has been decided that the best willow for bat-making is that Close-bark Willow botanically named above. It is of pyramidal growth, and a local form, believed only to be found in the counties of Essex, Hertford, and Suffolk at present, and from those localities cuttings as thick as a broom-handle, and 8 to 10 feet or more in length, or quite thin cuttings if desired ("sets") will have to be obtained in the first place, although it is probable that it will be very difficult to grow the best cricket-bat material for a number of years and after some disappointments. It may be that, at the antipodes, some other variety or hybrid, will under our conditions, produce a more valuable wood than the variety indicated. The lateral shoots should be so removed to encourage a straight, clear stem.

2. *S. babylonica*, L. (*S. pendula*, *Moench.*) The "Weeping Willow." Figured in Forbes, *Salict. Woburn*, t. 22.

A native of Japan; indigenous in North China, sparingly wild, according to Stewart, in the Himalayas; probably likewise in Persia and Kurdistan. Not a native of Babylon as its name would denote.

It is the commonest willow of the Sydney district and of New South Wales generally, for it seems to have adapted itself remarkably to our conditions.

I cannot at the present time ascertain when it was first brought to New South Wales; probably Governor Phillip brought such a hardy plant in 1788. If this be not a fact, it could readily have been introduced as a result of the

* These numbers refer to the Guide (with plan) to Sydney Botanic Gardens.

The Weeping Willow (Botanic Gardens, Sydney).

frequent communication between the Cape and Port Jackson. Some of the specimens in the Gardens sprang from cuttings brought from trees which grew around Napoleon's tomb at St. Helena.

It is a beautiful shade tree, so beautiful and so well known in this State that it is not necessary to insist upon it.

But it and other willows have great merits of preventing erosion (this has already been referred to), and many a stockowner knows how valuable their branches are as a standby in case of drought. They are employed for such a use in other countries, though what their comparative fodder-value is does not appear to have been ascertained.

*U 8 R; M 16, 26—Sydney Botanic Gardens.

* These numbers refer to the Guide (with plan).

3. *S. Caprea*, L. "Common Sallow" or "Goat Willow." Great round-leaved Willow." Figured in Forbes *Salict. Woburn* t. 122; *Eng. Bot.* ed. 3, t. 1331.

Native of Europe, Northern and Middle Asia. In Norway it extends to lat. 70° 37′; in 65° 28′ Prof. Schuebeler found it to attain a height of nearly 70 feet. The Kilmarnock Weeping Willow is a form of this species. Wood used for handles and other implements, the shoots for hoops; it is also largely employed for gunpowder-coal. Bark suitable for tanning, particularly glove-leather. It is one of the earliest flowering willows.

*M 7—Sydney Botanic Gardens.

4. *S. daphnoides*, Villars. "Violet Willow."

A common inhabitant of the mountain regions of Central Europe and Northern Germany, southern Scandinavia, northern Russia, Siberia and Manchuria; common in the arid regions of the inner Himalayas.

Often shrubby in habit, but in India sometimes becomes a tree 60 feet high with a tall straight trunk 3 or 4 feet in diameter.

In Northern India it has been successfully used to hold the soil on railway embankments and to fix shifting sands, its stout, far-spreading roots making it especially valuable for this purpose.

Often cultivated in North-west India to supply fodder for cattle. The bark is comparatively rich in salicin. The wood is used for construction, cooperage, and tool-handles.

5. *S. fragilis*, L. Called "Crack or Snap Willow," because in Spring-time a slight pressure causes the branches to break off from the stem. "Open-bark Willow" is another name.

Widely distributed over Europe and Western Asia and frequently cultivated for its reddish wood, which is considered more durable than that of the other European willows. It is used for the manufacture of children's cricket bats.

It is the common arborescent cultivated willow in Canada and largely used to make charcoal for gunpowder in Canada and the United States. This might be borne in mind when the Federal Government seriously undertakes the inquiry as to the best timbers of Australia (indigenous and exotic) for the manufacture of gunpowders for various purposes.

Flückiger and Hanbury state that from it a saccharine exudation is made in Persia.

The shoots are used for basket-making and wattling.

It is more erect than *S. babylonica*, but is a large, rapid-growing tree, a good companion for *S. babylonica*.

5A. *S. Russelliana*, Sm., the "Bedford Willow," is considered by some authors a variety of *S. fragilis*, and by others a hybrid between it and *S. alba*. The name *Russelliana* is now no longer used by the leading authorities on British willows.

* These numbers refer to the Guide (with plan).

It is probable that under *Russelliana* two willows have been included, one useful for bat-making, and the other the reverse. The use of the name is misleading.

A large tree not infrequently found in low grounds in Central and Western Europe, where it is often planted for the sake of its timber, or to produce poles.

Its bark also is valuable for tanning, while it is rich in salicin.

6. *S. mucronata*, Thunb. (*Syn. S. capensis*, Thunb., and *S. gariepina*, Burchell).

South Africa. Mueller suggests that this willow might be introduced on account of its resemblance to the ordinary Weeping Willow. Professor Harvey says that it is one of the greatest ornaments of the banks of the Gariep River.

7. *S. nigra*, Marshall. (*S. purshiana*, Sprengel). The "Black Willow" of North America, tab. cccclxii, Sargent.

One of the willows used for basket-work, although it is surpassed in excellence by some other species, and is more important as a timber willow.

Sargent says it is the largest and most conspicuous native willow of Eastern North America, but he does not praise this willow in any way. Nevertheless Mr. W. Scaling, of Basford, includes it among the sorts which he recommends in his valuable publication, "The Willow," London, 1871.

8. *S. tetrasperma*, Roxb.

Mountains of India, from 2,000 to 7,000 feet; height of tree reaching 40 feet. This thick-stemmed willow is worthy of a place on banks of water-courses. The twigs can be worked into baskets, the wood serves for gunpowder, the foliage for cattle-fodder.

OSIERS.

Nearly all willows, when properly cultivated, yield shoots suitable for the purpose.

Strong, low, but well-drained soil, heavily manured, and kept free from weeds, produces the most valuable shoots. Plantations are made by inserting cuttings in straight lines, the distance between the plants varying according to the species used, and the practice of the cultivator.

Osier holts, as these plantations are commonly called in England, continue productive for many years, and annually furnish 5 or 6 tons of shoots to the acre. Osiers are generally peeled, and the bark usually contains more or less salicin.

9. *S. cordata*, Muehlenberg.

A shrubbery species, one of the commonest and most variable of those of North America, ranging from the Arctic Circle to the Northern United States, and from the shores of the Atlantic Ocean to British Columbia and California.

There is a figure of a larger form, the var. *Mackenziana*, Hook, at tab. cccclxxix of Sargent.

One of the osiers of North America extending to Canada. Fit also to bind sand. One of the dwarf Californian willows has been found on the coast sands to send out root-like stems to 120 feet in length.

10. *S. daphnoides*, Vill. var. *acutifolia*, Anderrs. (*S. acutifolia*, Willd., or *S. pruinosa* var. *acutifolia*). "Russian or Caspian Willow." Called, also, the "Lemley or patent Lemley."

A very quick-growing species, which produces long rods suitable for basket-work chairs, and is grown freely on the Continent of Europe. It is easily recognised by its purplish-black bark, furnished with a white-waxy bloom.

This osier is commonly grown in Maryland and Pennsylvania, U.S.A., and gives good even-sized rods, which peel well. The white rods have a good colour, and are in demand for the better class of basket-ware and furniture. As it tends to branch, it should be planted in close order. Its heavy dark foliage casts a good shade, which keeps down weeds and undergrowth. On the whole, it can be highly recommended for planting, especially the patent Lemley (Hubbard).

Has been recommended for growing in sandy soil.

11. *S. fluviatilis*, Nuttall (*S. longifolia*, Muehlenberg, non Lamarck). The "Sand-bar Willow." Figured by Sargent t. cccclxxiv.

Usually about 20 feet in height, with a trunk only a few inches in diameter, and short slender erect branches.

From Quebec and Western New England to British Columbia and California.

"An inhabitant of river banks, the Sand-bar Willow is the first tree or shrub in all the northern interior region of the Continent which springs up on the newly-formed sand-bars and banks of rivers, consolidating them with its long rigid roots, and helping to build them up with the mud retained on the surface by its flexible crowded stems, and so prepares them for the growth of the poplars which line the banks of western and northern streams. (Sargent.)

12. *S. lucida*, Muehl. "Shining Willow," t. cccclxxiii, Sargent.

A bushy tree, occasionally 20 or 25 feet in height, with a short trunk 6 or 8 inches in diameter.

Inhabits the banks of streams and swamps from Newfoundland southward to Southern Pennsylvania, and westward to Eastern Nebraska.

The large dark green lustrous leaves and showy staminate aments of the shining willow make it a desirable garden plant.

13. *S. purpurea*, L. "Welsh or Purple Osier." "Bitter Willow."

The most commonly-grown osier in America, although its characteristics do not make it a good willow for peeled rods of a high quality. It is singularly hardy, and crops well, but the yield is small and the rods very hard. It deserves a place in willow culture, but should be put in the damper parts of a plantation, and not made the leading species. Perhaps, the most beautiful of all the northern willows. It grows slowly, and never attains a great size. It is the hardiest osier known (Hubbard).

A tall shrub, and one of the most variable of the Old World willows, distributed through Europe from Central Scandinavia southward, and through Northern Africa and Western Asia. The typical plant is a bush, with branches spreading downwards, and forms only comparatively short shoots.

Often cultivated as an osier plant, and in the United States more often planted in osier beds than any other, though in the dry hot climate of the Central States, it appears to produce less valuable material than in Europe. (Sargent.)

The bitterness of the twigs and leaves protects it from browsing animals, and increases its value as a hedge plant. (Scaling.)

Various hybrids and other forms of *S. purpurea* are used on the Continent for the finest fancy basket work.

14. *S. rubra*, Hudson.

Considered by some as a hybrid between *S. purpurea* and *S. viminalis.*

Throughout Europe, also in Western Asia and Northern Africa, much chosen for osier beds. When cut down, it will make shoots 8 feet long in a season. Dr. Porcher regards it as one of the most valuable species for work in which unpeeled rods are used. Unlike *S. purpurea*, it has upright long shoots, and is one of the finest, toughest, most pliable osiers, and one of the whitest when peeled. It is also admirably adapted for hedges. The bark is one of the best for salicin.

15. *S. triandra*, L. (*S. amygdalina*, L.). "Almond Willow," "French Willow," called also "American Green Willow."

Of all willows grown in America, this most nearly reaches Mr. Hubbard's ideal. It is everywhere in high demand, especially for furniture. It should be planted in fairly rich soil.

Largely cultivated in England, France, and Germany. Has the heaviest foliage of all the willows. One of its most serious faults is a tendency to branch. It is a valuable species. Its bark is rich in salicin.

Although its shoots and osiers are so largely grown in England for basket-work, it is generally known as "Willow."

16. *S. viminalis*, L. "Common White Osier" of England.

This may be looked upon as the type of the osiers.

A shrub or small tree widely scattered over northern, central, and south-eastern Europe, Western Asia, north-eastern India, Siberia, and Manchuria. Its long tough branches are used in basket-weaving, and in Europe, it is considered the most valuable of the osier willows.

One of the best known and most widespread osiers. The most generally adaptable of the species. "In spite of these faults (lack of durability and brilliancy of peeled rods), the sustained yield, vitality and clean rod of this willow will always hold it in the foremost rank." (Hubbard.)

17. *S. vitellina*, L. "Golden Willow." Figured in *Eng. Bot.*, ed. 3, t. 1311.

Looked upon by Kew, and many botanists as a variety of *S. alba* with yellow or reddish branchlets, but it has not, like that species, been found to contain salicin.

"In the treeless prairie and mid-continental plateau regions of North America, where the varieties of *S. alba* have been planted in large numbers, they grow under the most severe climatic conditions more rapidly than other trees, often flourishing in positions where these have been unable to live." (Sargent.)

It is readily recognised by the bright yellow colour of the bark of the annual shoots. In England, it is chiefly sold for binding purposes, *i.e.*, as a withy, in horticulture and agriculture, thousands of bundles being annually used by the market gardeners near London for binding celery and other vegetables, and by florists for binding packages of rose and fruit trees, &c.

(*To be continued.*)

A So-called Australian Weed in South Africa.

J. H. MAIDEN.

On and off since the war, I have been told of a weed known in South Africa as "Australian weed," because it is said to have come up wherever Australian troops were camped. It is only recently, however, that I have been able to obtain flowering specimens of the plant from a correspondent at Mafeking, South Africa. It turns out to be *Alternanthera echinata*, Sm., a South African plant. It is united in the Index Kewensis with *A. achyrantha*, R.Br., but it differs a good deal from that species, and s at least a good variety.

It is rather amusing to find that this South African plant has got such a ooting in parts of Australia that it is becoming a nuisance. The Mandowa Shire Council (Manilla) has, indeed, applied to have it declared a noxious weed under the provisions of the Local Government Act.

It has also made its appearance at Fernlees, on the Springsure line in Queensland, but does not appear to have been recorded as an alien in either State.

Alternantheras, little prostrate weeds, are very common in Australia, but the species at present complained of is South African, as stated.

Mexican Poppy.

Mr. Chas. J. Salter, of Llamboddon, Dubbo, furnishes the following particulars of his experience with the Mexican poppy (*Argemone Mexicana*).

This weed has been described on several occasions in the *Agricultural Gazette*, but as many of the present readers may not have seen the illustration of the weed, Mr. Grosse's excellent plate is reproduced.

"My experience of this plant is that in a paddock where it was growing very luxuriantly, and was also in various stages of growth, sheep in the paddock died for want of food. They would not even touch the poppy. I

ARGEMONE MEXICANA, LINN.

gave them salt, thinking this would help them to eat some of the plant, as I had often heard that if sheep were given salt they would eat almost any kind of food, but it proved quite useless with the Mexican poppy.

"The paddock mentioned must have carried some 3 or 4 tons to the acre of this weed, and the only means I found effectual for destroying it was by ploughing it up with a big disc plough. No kind of furrow plough could work for a yard through the dense mass of poppies.

"I notice that the Botanist is of opinion that the best time to destroy this weed is when it is in flower. It seems to me, however, to be always in flower—you can see growing continuously on the same stalk flowers, green pods, and ripe seeds. The plant is always green—neither winter or summer seems to affect it.

"It grows in all classes of land, even on stony ridges, where it is exceedingly difficult to combat.

"Great benefit would result from the discovery of some effective means of destroying the Mexican poppy, as it is flourishing in many districts, and looks as if it will soon take possession of the land, as nothing else seems to grow or flourish when it is established."

Mr. Salter adds that some time ago he had some hay with Mexican poppy plants in it cut into chaff. He noticed that his horses, after eating the chaff, would be seized with violent fits of gripes. He did not know at the time the cause of the malady, but as all the horses which ate the chaff in question were affected alike, Mr. Salter feels sure that the Mexican poppy was responsible for the trouble. Recently he has noticed the poppy growing amongst some barley which was cut green for the horses, but they would pick over the fodder and not touch a single leaf of the poppy.

Mr. J. H. Maiden, Government Botanist, says that the experience of Mr. Salter confirms the opinion generally held in this State that this plant is a useless and even poisonous one. Unfortunately the Mexican poppy is spreading over some of the best lands in the State.

A Fibre Plant.

The fibre plant, Uganda hemp (*Asclepias semilunata*), has been tested at the Experiment Farms.

At the Hawkesbury Agricultural College Farm, seed was sown 28th September, 1908, and germinated extremely well. The plants proved to be very drought-resistant, and during the dry summer experienced a growth of 5 feet was attained.

Where the plants grew thickly, the growth was tall and straight, with scarcely any branches; but where the plants stood far apart, a large number of branches were formed.

Seed pods formed in February, and ripe seed was available in April.

At Wollongbar Experiment Farm, the crop was irregular, and the growth was only 3 to 4 feet at the end of six months.

At Grafton Experiment Farm, the plants from seed, sown broadcast, 7th September, 1908, grew very slowly, and by 2nd March, 1909, when seed was available, had reached a height of barely 4 feet.

The Manager of the farm says that in comparison with other fibre plants, such as Ramie, this hemp does not compare favourably, and he is of opinion that it is not of much commercial value.

At Moree Farm, the Manager formed the opinion that irrigation was essential for a profitable crop. Without irrigation the plants attained a height of from 2 to 3 feet only; but where irrigated they made a growth of 5 feet 4 inches in six months. From its free seeding habits it might become a pest in loamy soils in moist climates.

At the Wagga Experiment Farm, the hemp made fairly good growth. Mr. McKeown considers that this plant is very similar to that which, in the neighbourhood of Sydney, we used to know as Wild Cotton.

Preparation of Fibre.

Concerning the preparation of the fibre of Uganda hemp, Mr. R. G. May, Acting-Experimentalist, Hawkesbury Agricultural College, reports:—The stems were dried for ten days, this long period being necessary owing to the prevalence of damp weather and fogs. When dry, the stems were retted for eight days, when they were again well dried. Difficulty was experienced in removing the bark from the wood, both adhering closely one to the other. The bark was ultimately removed by being stripped off with a knife—a slow, laborious, and uncommercial method.

In separating the fibre from the vegetable matter difficulty was again experienced. The approved method of pounding the bark was unworkable, a sample of the product of such a method being seen in sample No. 2 (Fig. 2). Resort was made to pulling out single fibres and stripping off any vegetable matter that adhered to them, so as to secure a general sample of the fibre as should be obtained if it lent itself to approved commercial methods; such as is to be seen in sample No. 1 (Fig. 1). The fibre is glossy, and will probably lend itself readily to dyeing processes. It is tender and will not stand much tension. Twisted into a thread, it breaks easily and does not compare with cotton for strength. An attempt was made to secure a sample by treating the fibre with acid and caustic solutions. A sample of the resultant product is shown in Fig. 3. The process seems to have rendered it much weaker, though it produces material that would probably pass through the commercial operations necessary in manufacture.

Beware of Throttling Trees.

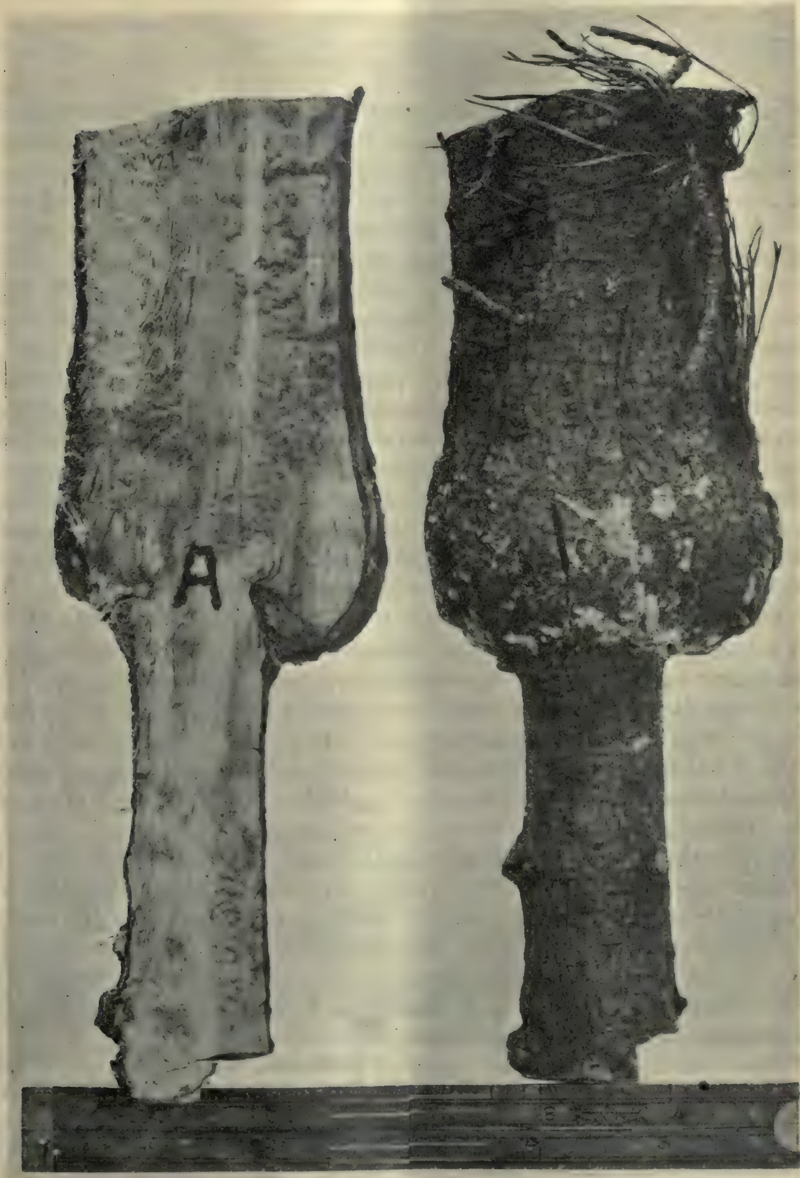
A gentleman brought a young *Pinus radiata* tree (commonly known as *insignis* by Sydney nurserymen), from which the enclosed photograph was prepared. It grew on a high part of the Blue Mountains, and was three years old. The thin diameter is near the ground line, the thick stem is in a diseased condition. The cause of death was unknown, or, rather, could only be guessed at, but the cutting of a vertical section soon made the matter quite clear.

When the tree was planted out the tie (probably a bit of tarred string) was forgotten. It will be seen right and left of the letter A in the photograph. The photograph, although a good one, and very instructive, does not show the cut ends of a bit of string very well, but there is no doubt of its presence, as I teased it out with a knife.

UGANDA HEMP PREPARED AT HAWKESBURY AGRICULTURAL COLLEGE.

1—Fibre 2—Fibre resulting from pounded bark. 3—Fibre resulting from acid treatment
4—Stem after stripping. 5—Bark. 6—Down produced in seed-pod.

The moral is, watch the ties. Ties should be removed and replaced (if necessary every year. Many cases of absolute destruction of good trees



through neglected ties have come under my notice in New South Wales. Ties also may harbour vermin. This is well known to fruit-growers.—J. H. MAIDEN.

Locusts in Australia and other Countries.

WALTER W. FROGGATT, Government Entomologist.

SINCE the formation of the Department of Agriculture in New South Wales, a number of reports, notes, and articles have been published in this *Gazette*, dealing with plague locusts. Information is, however, always accumulating; and within the last few years some valuable reports have been brought out in other countries, with results of field work conducted in Australia, so that it has become necessary to supplement our former work.

In considering the locust problem, and the conditions under which these insects appear as pests in the western and south-western plains, we may learn much from the methods that have been adopted in other countries. It has been pointed out often that the locust is, in the first instance, a desert insect; that it breeds in the desert or unoccupied lands, and then flies to cultivated or fertile grass lands, and that after devouring everything in its way, it deposits immense quantities of eggs before it completes its life cycle. Therefore, though the first invasion of locusts may be bad, the second one may be very much worse; and it, too, may be followed by several years of local locust plagues until unfavourable weather conditions, the accumulation of parasites, or natural degeneration, as the locusts work away from desert lands, put an end for the time being to the infestation. There will always be a large area of uncultivated or untilled land in Central Australia, where the plague locusts may breed; and we may expect this plague at any time in a very large portion of some of our richest lands. Most of this land, covered with natural grass and herbage, is exactly in the same condition as when it was first leased by the pioneer squatters from the Crown. A small portion here and there may have been ringbarked to improve the grass, but comparatively speaking it is all used for grazing sheep or cattle.

It is in the destruction of grass and herbage that the locusts cause the greatest losses, and particularly to those stock raisers who go in for fattening lambs; for it is the young grass just needed to top them up for the market that the locusts eat, and thus the stock is starved. Though the money value destroyed must be considerable (I have been assured on good authority, that it has often meant as much as £1,000 in one season to many), the loss is not so apparent as if it were in cultivated crops.

Now with closer settlement, better and cheaper methods of cultivation, increased railway facilities, and proper fertilisation of crops suited to the land, the farmer has, within the last twenty years, moved out westward and northward into districts where it had never been suspected that wheat could be grown as a paying crop under any conditions; and thus he has come within the locust zone, and has suffered from their attack, and is liable any season to lose his crops; for with the clearing of the belts of scrub that confined the locusts to certain areas, they have extended their range; and,

all things being equal, large fields of cultivated crops of hay, wheat, and lucerne, will mean abundance of food to encourage more locusts.

On the outer fringe of the farming land, the favourite nesting grounds of the adult locusts are the "scalded plains." Those consists of level red-soil flats, lightly covered with scattered scrub trees and a few larger eucalypts, often flanked with low sand-hills formed by the wind sweeping over these flats and accumulating the soil in hummocks; thus areas of bare ground are left hard and compact after the surface has been swept off, and admirably adapted to the auger-like ovipositor of the female locust, which cannot operate in soft, friable soil.

Very often the locusts may be found egg-laying at the paddock gates where the traffic has increased the hardness of the soil; the passing sheep clear off more bare patches, and the flying swarms stop and lay their eggs where they find a suitable halting-place.

One of the reasons why active united measures have never been taken by the land-holders, or by the Government (as has been done in other locust-infested countries), is because it is an intermittent pest, only appearing in an acute form every few years, and not always in the same districts. Locusts may appear in immense swarms for two or three years in succession in different parts of the State, and in the following year there will be none. Therefore, the man on the land takes no precaution, nor does he even notice the hatching-out of the baby locusts, though he knows where the last year's swarms deposited their eggs upon his land. He may have lost grass worth £500 to him last summer; but when you tell him that he can kill all the young locusts for £50 in actual cash, he will not undertake the work.

The average squatter or large farmer will ride through swarms of baby locusts day after day on his rounds; he will watch them gradually develop, and console himself with the thought that when able to fly they will move on to someone else's paddocks, or that rain or storms may kill them. Even when a few of the more enterprising men get up a demonstration by an expert, who can show them the exact cost of killing the locusts, they will hardly trouble to ride across the paddocks to see what is going on at their neighbour's place.

Therefore, the very fact that the locust is not a regular annual pest and that it is not always in evidence, accounts for the apathy. It is not until winged swarms come flying over the country—when it is very difficult to deal with them on a large scale—that paragraphs appear in the country newspapers calling attention to their ravages; and it is asked what is the Government doing; and demands are made for a "remedy."

While the people interested in the matter take this stand it is very difficult to see what can be done to mitigate locust plagues; yet within the last twenty years there have been a number of very severe infestations of locusts over large areas in New South Wales, that meant the loss of many thousands of pounds to the land-holders in particular and the State in general, because the wealth destroyed was just as much lost as if the infested land had been swept with a bush fire.

The warnings issued at the time of the appearance of swarms of helpless baby locusts are forgotten; one is met with exactly the same remark that the orchardist used, in a different way, before the passing of the Fruit Diseases Act: "What use is it for me to destroy the pests on my land if my neighbour is not compelled to kill those on his land; because as soon as I have killed all in my paddock, those on his, or on the Government waste lands beyond, will swarm in and eat up the grass I have saved."

The treatment of locust plagues has been undertaken with considerable success in other countries; and there is no reason why we also should not be able to cope with them. If the stock inspectors who are in touch with all the land-holders were informed in time, and a gang of men set to work on the young locusts either by poisoning or spraying, or both, the locust would not be a persistent pest for several years but would never get into the second year. We are quite beyond the experimental stage; we know how locusts can be destroyed; the question is, who is to do it; the land-owners who get the direct benefit from their destruction, or the general community who indirectly gain by their destruction, in the added wealth to the country? In other countries it has been worked by the Department of Agriculture; and large sums of money are voted for the special work of locust destruction, officers being appointed to see the work carried out in the field.

Definition of a Plague Locust.

Plague locusts, or plague grasshoppers—for in several countries the term locust and grasshopper are applied to the same insects—may be defined as locusts that have gregarious habits, *i.e.*, that swarm together when they emerge from the eggs; the eggs, in most cases, are laid close together in small defined nesting-grounds, and after the insects grow up and take flight they still remain in swarms.

Several species that under normal conditions are found scattered about in twos and threes on the grass lands, now and then, for some unexplained reason, acquire the gregarious habit and suddenly appear in the district as plague locusts; and thus they might be called occasional plague locusts.

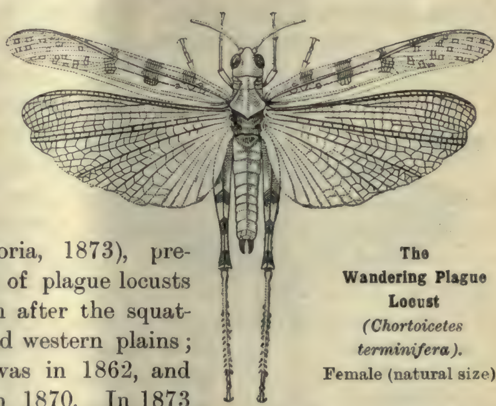
The typical locust has well-developed flying wings folded beneath the pair of straight narrow fore wings when the insect is at rest; short antennæ standing out in front of the head, a short somewhat cylindrical body furnished in the female with a set of four horny or chitinous plates surrounding the ovipositor, with which she can cut (as with an auger) a circular hole into the hardest ground, in which she deposits her eggs.

The typical grasshopper is never gregarious in its habits; it is of a somewhat general form to the locust proper, but has long slender many-jointed antennæ, generally curling round over the head, and carried along the sides of the body The ovipositor is sabre-shaped and projecting, and forms a regular sheath through which the eggs are deposited in rows on the twigs of plants or grass-stalks, to which they are fixed by a gummy secretion similar to that used by the plague locusts to envelop their mass of eggs when depositing them in the ground. They usually go about in pairs living in the long grass or among the foliage of trees.

The Wandering Plague Locust (*Chortoicetes terminifera*, Walker).

This is our commonest plague locust that ranges from the interior of Australia into the northern and western districts of Victoria, South Australia, and New South Wales, and at times, when in swarms, appears in the coastal districts.

It has been described under a number of different names. When Walker named it in his British Museum Catalogue, 1870, he described it as *Epacromia terminifera* from Australia, without any exact locality. Bath figured and described it under the name of *Decticus verrucivorus* when writing up the visitation of this plague locust, which spread nearly all over Victoria in 1873. Olliff described it as *Pachytylus australis*, in the *Agricultural Gazette*, when recording its ravages all over the interior and southern plains of New South Wales in 1891; and the specimens that Koebele received from South Australia were identified as *Chortologa australis*. But I believe there was some mistake, unless there were two species concerned in the 1891 invasion, for Tepper, in an article contributed to the *Garden and Field*, identified it correctly as Walker's long-described species.



The Wandering Plague Locust *(Chortoicetes terminifera).* Female (natural size).

According to Bath (*Agricultural Journal*, Victoria, 1873), previously noted, the first record of plague locusts in Victoria was in 1848, soon after the squatters took up the northern and western plains; the next serious visitation was in 1862, and their next appearance was in 1870. In 1873 they came in great swarms as far south as Bendigo; and in 1876 they were again abundant on the northern plains. Since then most of the southern swarms recorded in New South Wales have spread over the plains south of the Murray River.

This locust has been described and figured a great many times, so that it can be easily recognised—first in the *Agricultural Journal* of Victoria, in colours, next in the *Agricultural Gazette* of New South Wales by Olliff in 1890, in black and white. In French's "Destructive Insects" (Victoria, Part III, 1900), it is figured in colours (pls. xxxvii–viii). In my series of papers in the *Agricultural Gazette* ("Locusts and Grasshoppers," 1903), it is again figured in colours, and this illustration is reproduced in *Australian Insects*, 1907. This locust measures about 1½ inches from the front of the head to the tip of the folded wings, with a wing expansion of another inch when flying. It is of a general light-brown colour, mottled and splashed with darker brown of somewhat variable pattern, forming an irregular band of spots along the front edge of the fore wings, becoming broken up into smaller scattered spots at the extremities. The most distinctive marking is

a clouded brownish tip on the semi-transparent hind wings, never, as in most species, forming a large blotch, but always distinct when the wings are extended.

The Eastern Plague Locusts (*Œdaleus Senegalensis*, Krauss).

This locust was figured and described in my papers on "Locusts and Grasshoppers" in the *Agricultural Gazette*, 1903, under the name of the "Blue Mountain Locust," as I had found it upon all the open grassy flats among the mountains; but subsequent investigations showed that it has a considerable range along the eastern coast lands, and that under favourable conditions it sometimes becomes a plague locust.

In 1907 this was the species that did a great deal of damage to the pasturage in the Singleton district of New South Wales, and deposited its eggs in several well-defined areas. The broods were, however, too late that season to do any damage to the crops, which had been all harvested before they appeared. They did not congregate in such immense swarms as the western plague locusts, but were regular swarm locusts. In a paper, "The Eastern Plague Locust" (*Agricultural Gazette*, 1907), this outbreak was described, and the eggs of the locust and the life-history of a dipterous fly parasite were figured and described.

The Eastern Plague Locust (*Œdaleus Senegalensis*).

This locust was originally described from Eastern Africa, from which fact it takes its specific name. In general appearance, with its wings folded, it might easily be mistaken for a small "yellow-winged" locust. If, however, the wings are opened and spread out it will be found that both the markings on the fore and hind wings are different. The locust, firstly, is much smaller, only about 1½ inches in length, with a wing-expanse of only 2 inches; secondly, the fore wings are much blotched with blackish-brown, the extremities lightest; while lastly, the hind wings have the yellow area adjoining. The body is smaller, and very pale in tint, the black encircling band contracted in front swelling out again and tapering behind the semi-transparent outer area, forming a marginal band right round the outer edge of the wing, with the tips always clouded with black.

The first account of this locust is by the German naturalist Krauss, in his *Orthoptera of Senegal*. Saussure records it from Ternate and Australia, but no more definite locality is given. The locusts, when infesting the Singleton district, laid their eggs on hard clay, open, grassed ridges; these eggs were deposited in pods, containing from thirty to fifty eggs, in pits almost 1¼ inches in depth.

The Large Coast Locust (*Acridium maculicollis*, Walker).

This is one of our largest locusts, usually solitary in its habits, but sometimes congregating in the gardens; and it ranges north from Sydney to North Queensland; the northern specimens often being much larger than those found in the southern latitudes.

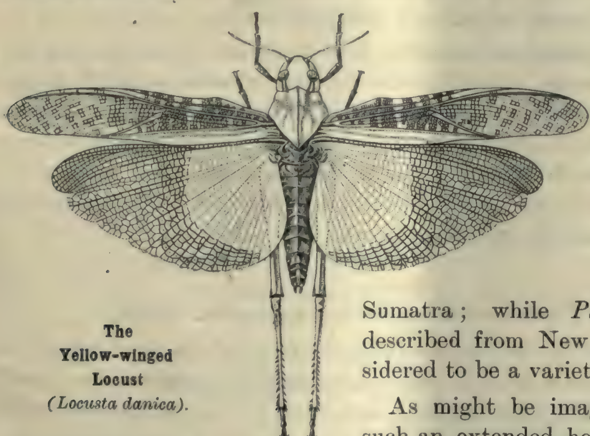
The female measures up to 3 inches from the front of the head to the tip of the wings, when closed, and across the expanded wings often measures nearly 5 inches.

Large Coast Locust *(Acridium maculicollis).*

The general colour is dark greyish-brown, thickly mottled with dull reddish-brown; the head and thorax spotted with irregular black marks, and the sides of the abdominal segments marked with two little spots; the thighs of the hind legs blotched with black along the upper edge, and the shanks marked on the upper surface with the same colour, with the tibial spines red at the base, and black at the extremities; the hind wings semi-opaque, with black nervures, and the basal portion shaded with light blue.

The Yellow-winged Locust (*Locusta danica*, Linn.).

This large handsome locust has a wide range over the coastal districts of Australia. It is usually found in open grassy flats, or lightly-timbered country. Generally it lives in groups of two or three, and sometimes in small widely-scattered parties of up to a hundred; occasionally, however, it appears in swarms and becomes a regular plague locust, though over only a restricted area.



The Yellow-winged Locust *(Locusta danica).*

This locust has a very wide distribution. Originally described from the south of France, it is recorded from India, Africa, Madagascar, Ceylon, the Philippines, the Malay Archipelago, Java, Sumatra; while *Pachytylus cinerascens*, described from New Zealand, is now considered to be a variety of this species.

As might be imagined, an insect with such an extended home has been described and placed under a number of different names. In Henri de Saussure's monograph on the group, he says that Thunberg described it under the name of *Gryllus marmoratus*, and three other varieties under distinct names.

Another writer on Orthoptera, Stoll, called it *Gryllus flavus*, on account of its bright yellow wings; and Burmeister gave it a new name, *Œdipoda citrina*, for the same reason. Serville christened it *Œdipoda musica* on account of the distinct note it makes when flying up out of the grass.

It was figured in colours by Leach, in his "Zoological Miscellanies," 1814, as the painted locust (*Gryllus pictus*), common in Australia. In McCoy's "Prodromus of the Zoology of Victoria," 1885, on plate 110, this handsome locust is illustrated in colours under the name of the Australian Yellow-winged Locust (*Œdipoda musica*).

Mr. W. F. Kirby, in a paper describing a collection of locusts from South Africa, read before the members of the Entomological Society of London, determined this species, as the one described by Linnæus, in 1750, under the name of *Gryllus danicus*, and at the same time placed it in the Genus *Locusta*. Like many other common showy insects, there is some doubt about its identity. When in London, I examined the remains of Linnæus' type in the British Museum with Mr. Kirby, and he expressed a doubt as to the exact position of our yellow-winged insect.

This is one of our larger locusts; the female often measures 2 inches in length, with a wing expanse of over 3 inches; the head and thorax are reddish-brown, usually thickly shaded with bright green, the hind portion of the thorax often forms a regular crest behind the head, which is broad and thickset. The fore wings are reddish-brown spotted with white, which forms a number of narrow white transverse lines about the centre, and irregular wavy mottled areas at the tips. The hind wings are broad and fan-shaped, the inner halves rounded to the body bright yellow, margined with a broad blackish band which, broadest in front, tapers round behind; outside this the wing is semi-transparent, sometimes with a faint blotch of blackish-brown at the extremities. In McCoy's plate, this is well-defined; but, usually, it is wanting in our specimens, or else very lightly indicated.

The locust is easily recognised as it flies from the grass by its size, and the bright yellow of the wings, as well as by the loud musical sound it makes when rising. We have several records of this locust having been more or less of a pest in orchards in Victoria and New South Wales, where it seems to be fond of the leaves of the vine.

When they gather together under favourable conditions, these locusts can do a great deal of damage to grass and gardens.

The Smaller Plain Locust (*Chortoicetes pusilla*, Walker).

This is the smaller of the two common plague locusts of the central districts of Australia. During the last ten years it seems to have spread over much of the country where the larger plain locust used to be the most common species and did all the damage; and to a great extent it has replaced the larger variety as a plague locust in the western districts of New South Wales. It was during the investigations carried out by me in the Condobolin district during the 1899 plague, that this was determined as another species of locust

distinct from *C. terminifera* ("Plague Locusts," *Agricultural Gazette,* 1900). At this time we carried out a number of experiments with the African locust fungus, but with very poor results.

The smaller plain locust remained a pest in the Condobolin and other districts from 1899 till 1902, when the very early frosts and utter absence of any kind of food in the vicinity of the nesting-grounds were probably the chief factors in its disappearance.

The male locust is much smaller than the female, measuring only about 1 inch in length and 1½ inches across the outspread wings. When alive, its general colour is bright yellow, with a brownish tint upon the upper surface of the head, thorax, and sides. The fore wings are finely mottled with black and brown; the hind wings are semi-transparent, not marked with brown or black, except at the extreme tip, which is sometimes clouded with brown; the legs are bright yellow, with a few brown marks on the thighs.

The female is about ¼ inch longer than the male; is of a general brownish colour, with the fore wings blotched with brown, and with the thighs of the hind legs mottled with the same colour, and the shanks yellow. The habits of this species have been noted in the papers previously mentioned, but there are some points that might be noticed here.

The Smaller Plain Locust (*Chortoicetes pusilla*).
(Much enlarged.)

Towards the end of the 1899 plague, it was noticeable that the broods hatched out in the 1902 season were very much darker in colour and smaller in size than those of previous years. The egg masses, of which great numbers were examined in our field work, contained, on an average, only nineteen eggs; but as soon as the first batch of eggs was laid, mating was renewed, so that probably a further batch of eggs was deposited the following month.

This locust, in the western country, deposits her eggs on the red-soil plains in November, and her second batch of eggs is deposited within a month.

The remarkable habit of the males clustering together round the egg-laying females on the red-soil plains, is described in my paper in the *Agricultural Gazette,* 1900. The locust is figured in colours in the November *Agricultural Gazette,* 1903.

The Large Mottled Locust (*Locusta australis,* Brunner).

This large locust is common in the coastal districts of New South Wales and Queensland, where it is found, in pairs, in long grass in open forest country.

It measures about 2½ inches from the front of the head to the tip of the closed wings, and 3½ across the outspread wings, and is of a general brown

colour. The fore wings are very finely mottled with darker brown, and the hind ones are not clouded, but of a uniform light brown tint. This species was described by Brunner from Oceania, Fiji, and Tongatabu.

Large Mottled Locust *(Locusta australis).*

This is the locust that attacked the sugar-cane in southern Queensland, at Childers, in 1904, when Mr. T. H. Wells, of Farnboro, used screens and drove them into shallow pits 25 feet long.

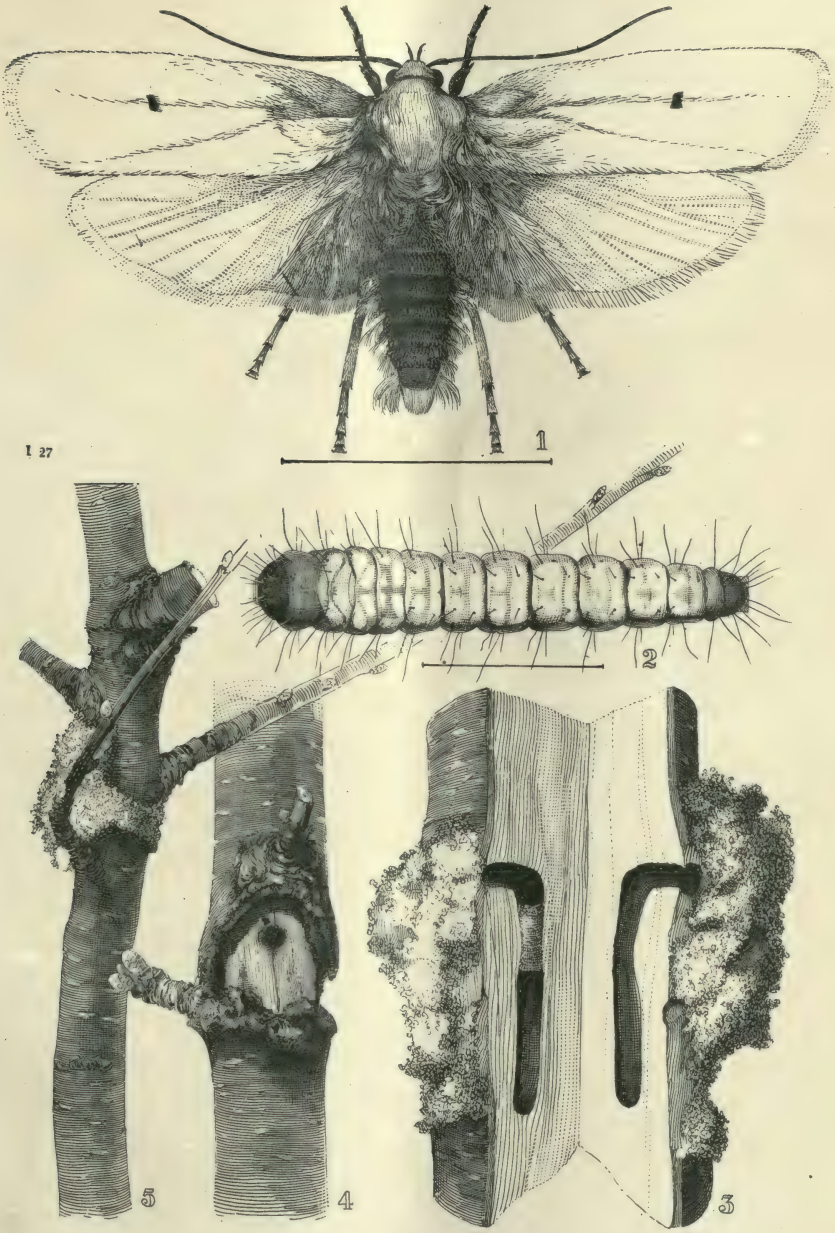
The Colonial Sugar Company's plantations at Childers were also invaded by swarms of this locust, but they were checked in a similar manner, and destroyed before they had time to do much damage to the growing cane.

(To be continued.)

Cherry Tree Borer.

The life-history of this destructive pest is depicted in the accompanying plate.

The Assistant Entomologist states:—"Trees should be continually inspected during the next few months, and where borers are noticed to have entered the branches the webbings and excrement should be rubbed off and wire inserted into the bores to injure the grubs. Even the slightest injury causes the death of the grubs. Instead of wire, blue, red, kerosene, or other oil squirted into the bores is effective. Further, the bores should be plugged with grafting wax, soap, or clay, or else with rag or wooden plugs dipped in Stockholm tar or oil,"



THE CHERRY-TREE BORER.

(CRYPTOPHAGA UNIPUNCTATA, DON.)

1. THE MOTH. 2. THE GRUB.

3, 4, AND 5. SHOWING HOW THE GRUB BURROWS INTO THE GROWING LIMB AND DESTROYS IT.

Entomological Notes.

WALTER W. FROGGATT.

Planters' Friend destroyed by Insects.

The Manager of the Grafton Experiment Farm has forwarded specimens of the seed-heads of this fodder plant which are webbed together and seriously damaged by some undetermined moth caterpillar.

Respecting the pests he writes:—"I estimate that 35 per cent. of the heads are attacked by grubs; they do not destroy all the seed in a head, but make all the fodder uninviting for the stock."

The specimens received by me on the 14th of May were matted together, and most of the seeds were gnawed. The insects that are doing the main damage are lepidopterous larvæ. These caterpillars burrow inwards and hide along the stem, and, covered with the seed-head, they pupate among the seeds in silken tubes. When fully grown they measure about ¾ of an inch in length, are elongate in form, and vary in colour from pale brown to dull white, often with a faint tinge of green beneath the skin. The head is black, flattened, and slightly cleft behind, so that it appears to be lobed; the mouth parts are of a lighter brown. The thoracic and abdominal segments are thickly variegated with small, irregularly-rounded blotches of dull green, and in the centre of each is a black dot, from which springs a fine black hair. When viewed on the upper surface the first thoracic segment is clouded with dull reddish-brown; the second and third thoracic segments banded with a row of greenish spots, the four largest occupying the dorsal surface. Each of the abdominal segments has four rounded blotches forming a square pattern in the centre of the back, followed by a row of smaller spots down the sides of each segment; in those without legs or prolegs, going right round, forming a regular ring round each segment. The anal segment is rounded and lightly clothed with scattered black hairs.

Though this is evidently the insect doing the damage, there were quite a number of small insects feeding upon, or sheltering among the seeds.

A small moth (*Sitotroya cerealella*, Oliff) was obtained from one head, and a number of small caterpillars that appear to be the larvæ of this moth were taken crawling about in the rubbish in the jar.

A number of very dark-coloured specimens of the small grain weevil (*Calandra oryzæ*) were shaken out of the heads; also a smaller undetermined beetle. A very handsome little winged Psocid and a great number of the wingless larvæ take shelter among the seeds. A small red bug in all stages of development was present also; while numbers of four different species of tiny wasps, parasitic upon the different larvæ in this shelter, were obtained.

The moth doing the damage will be bred from the larvæ, and identified in due course.

Certainly the best and only method to get rid of this pest is to cut off and burn all the infested heads of Planters' Friend in the paddocks, and, if done in time, every grub could be destroyed.

A Butterfly damaging Uganda Hemp.

An interesting example of a butterfly discovering the affinity of a cultivated hemp to its common food plant has been noted by Mr. H. B. Alexander, Manager of the Wollongbar Experiment Farm.

The large common black and dull reddish-coloured butterfly, *Danais menippa* (better known under the name of *Danais archippus*), originally a native of North America, where it is known as the "Brown Gypsy," was found laying her eggs upon the foliage of the Uganda hemp (*Asclepias semilunata*), which the handsome banded caterpillars were devouring.

This butterfly's food plant is an introduced herbaceous weed commonly called the "bladder weed" (*Gomphocarpus fruticosus*), which has spread all over the coastal country, until it is now a regular weed upon the roadside, and in uncultivated paddocks.

Both the Uganda hemp and the bladder weed belong to the same natural order, Asclepiadaceæ.

It is therefore evident that if this hemp were grown here widely, it might have a very serious enemy in the caterpillars of this common and abundant butterfly.

The destruction of all the bladder weed in the vicinity of the hemp would help to keep the butterfly down.

Examination of the Insect-food in the Stomachs of Rainbow Trout.

At the request of Mr. C. H. Gorrick, of the New South Wales Anglers' Casting Club, I have examined the stomachs of a number of these trout captured in the Snowy and Bredalbane Rivers early in the year. The results are very interesting. The trout apparently take all kinds of insects—locusts, cicadas, beetles, and moths that fall, or are washed into the rivers by storms; yet their natural food is the several species of the large neuropterid stone-flies belonging to the *Perlidæ*. The larvæ of the *Perlidæ* live in the bottom of the streams, and the adult flies are probably captured soon after they have emerged from their pupal skin, or else are caught while they are laying their eggs.

The Determination of the Value of Birds as Insect-destroyers from the Examination of their Stomachs.

The examination and tabulation of the different food remains found in the stomachs of birds is a very interesting study that has been carried out for many years in Europe and America.

In the latter country, the Federal Department of Agriculture at Washington has a Bureau of Biological Survey, which has a staff who study the food habits of the birds. There is also a museum collection of many thousands of stomachs of birds, together with mounted specimens of all the best-known birds.

The Director of the Bureau of Microbiology (Dr. Tidswell) receives numbers of dead birds, and has directed that the stomachs be saved, and the contents sent to the Entomological Branch, so that the insect remains in the stomachs can be examined and the different species of insects tabulated.

It is to be hoped that this is the beginning of a systematic examination of a large series of each species of our common birds. It may be pointed out that to be of any economic value a series of experiments should be carried on all the year round with the same species of birds, for the food obtainable in midwinter is very different to that taken by the bird in midsummer.

Prohibition against Introduction of Fruit Pests into Victoria.

In a recent proclamation issued by the Victorian Government, introduction of fruit or plants infested with insects (beetles, eggs, or larvæ) of the following genera—Bostrychidæ, Scolytidæ, and Cioidæis—prohibited. The Entomologist reports that beetles of the families Bostrychidæ, Scolytidæ, and Cioidæ, mentioned as now being included under the Victorian Vegetation Diseases Act, are chiefly forest pests. They are small boring beetles in both grub and adult stages, and attack the wood and bark of trees. Some have become orchard pests, and a few likely to be met with here are mentioned below.

Borers, being internal feeders, are difficult to deal with, and preventive measures are recommended where the beetles are about, such as painting orchard trees with whitewash poisoned with a little Paris green, or with strong whale-oil soap, to which add a little crude carbolic. This deters adult beetles laying eggs, and destroys some of the newly-hatched grubs entering the bark. Treat trees attacked by pruning and burning infested twigs. Also many grubs may be destroyed by injecting oil into the open bores, or inserting wire to destroy the grubs, or plugging the bores with oiled rag, &c.

Bostrychidæ.

Small beetles (few are more than ½ inch long), black or brown in colour, cylindrical, with the appearance of being cut off squarely at both ends—the head being deflexed and the hind end truncate.

A rough, black, cylindrical species about ½ inch long (*Bostrychopsis jesuita*) occasionally attacks orange-trees—generally weak or dying trees, however.

Bostrychus cylindricus, a smaller species, has been recorded on two occasions boring in wine cask staves, and causing loss through leakage.

In Victoria, Mr. French has recorded a pest of apple-trees in *Apate collaris*, a small beetle which bores in the trunk and branches of apple-trees. In America another small species of this family, known as the Apple Twig Borer, is occasionally a pest.

Scolytidæ.

These borers cause the curious hieroglyphic markings to be seen on forest trees when the bark has been removed. Included are the Ambrosia beetles, which grow fungus in their bores, and the family causes serious loss by riddling timber trees.

In New South Wales two species have become orchard pests, viz., the Fig-branch Borer (*Hylesinus porcatus*), which bores in the twigs of both native and cultivated fig-trees, and the Shot-hole Borer (*Xyleborus solidus*), a small black species which sometimes riddles apple-trees.

Cioidæ.

Of this family the one most frequently met with is *Lyctus brunneus*, which attacks rattan furniture, baskets, lining-boards, and new furniture. The grubs and adult beetles are only about ⅙ inch long, and when numerous reduce a piece of wood almost to powder. Accumulations of this wood powder in the house are a sign of the presence of these beetles. They prefer to feed in the sapwood of beams and boards.

The Wire-worm and Oats.

The wire-worm has appeared in Tasmania and attacked the growing oats, thus checking its growth. Fortunate Tasmania, to have only now been visited by this pest! It is described as a "long, narrow, rigid grub, and eventually turns into a beetle." From this description, and the way it attacks young growing oats, I am of opinion that it is the same, or very similar to what is known here as the cutworm. During dry seasons this pest attacks young growing oats in droves. When the plants are about 2 to 3 inches high, they can be seen crawling along the drills in long rows. As the leaders come to the oats, they set to work, and those behind travel on to the front. When the original leaders have cut down all of the young oats around them they then march on past the others, keeping to the same drill or small gutter, and this process is continued. If they would only content themselves by eating what they cut down one would not complain much, because, being so small, it would not take a large quantity to fill them. But, as it is, farmers lose acres of valuable crops when they most need it. In this district they are in old ground that has been worked for many years, some of it over sixty years, and on the light-coloured poor patches on the

hills. We lost some acres through the cut-worm last season. I made inquiries from our oldest and most experienced farmers, and was told that the only thing to do was to let the land rest for two or three years. Feeling that that was a somewhat slow process, I determined to plough the ground as early as possible, and got 12 tons of air-slacked lime (to save time, as water-slacked should have been used, as it is more soluble), and spread it over the light-coloured parts at the rate of about 1 ton to the acre, and harrowed it in. The effect was marvellous, as shortly afterwards thousands, possibly millions, of the little brutes were seen stretched out dead on the surface.

As soon as we finished harrowing the lime in, we set to work sowing sheep's burnet on about 60 acres, and ploughing in across the "combs" wheat, some of which was broadcast, but most of it put in with a plough that had a seeder attached, and covered the seed, thus saving harrowing. The drill was not used for two reasons: firstly, I wanted to do away with the good travelling road it left for the cut-worms to get at the young crop when it came up, and force them to look for and work hard singly for it, as, thus sown, each worm would have to be by itself at a single plant, instead of working in droves as they did last year. Secondly, the drill was required to spread the sheep's burnet seed on the surface, to be covered with the harrows hanging on behind.

What I am told is known as the cut-worm there, is a thin, whitish worm, about ¾ of an inch long, and has a small, brownish head. We have not noticed any at work so far this year, and know the paddock lost many thousands, and hope that we have found a means of preventing in future the mischief they do.—W H. WEBB, Bathurst.

NATIVE BEE SAID TO FERTILISE RED CLOVER.

MR. A. HAMMOND, of Rose Vale, Byron Bay, writes: "*re* article on native bees in recent number of the *Agricultural Gazette*. I grew Red clover here eighteen years ago and it was fertilised by several kinds of native bees. That the clover was fertilised there can be no question. The crop was sown in virgin soil, and young seedlings came up freely the year following."

Mr. Hammond forwarded a specimen of the bee which, in his opinion, is one of the native varieties which fertilise Red clover. Mr. Gurney, Assistant Entomologist, identified the bee as *Sarapoda bombiformis*, a long-tongued solitary species, similar to one captured recently in the Illawarra district.

MAIZE WEEVIL, AND CABBAGE, POTATO, AND BEE MOTHS.

A CORRESPONDENT, discussing a paragraph in regard to the apparent immunity of maize grown in certain districts from weevil, says: "I never saw weevil in the Bega district, which is only a few feet above sea-level, but the reason, in my opinion, is that the moth that breeds them cannot live in so cold a climate. I have robbed, in my young days, scores of hives of bees in the South Coast and in the Mudgee districts, but never saw any moth in them."

The Assistant Entomologist, in reply to these remarks, has furnished the following notes, which, it is thought, may be of general interest:—

The grain weevil (*Calandra oryzæ*) is a beetle, and at no stage of its life-history is it in the form of a moth. It might, however, be easily confused with a very destructive moth—the Angumois grain moth—which destroys grain much as weevil do, but the grub of the moth is a tiny, six-legged caterpillar, whereas the grub of the weevil is a short, fleshy, legless creature.

Briefly, the life-history of the grain weevil is as follows:—The female beetle eats out a small portion of a grain and deposits an egg there. From the egg hatches a tiny, legless grub, which feeds inside the grain. When full grown the grub transforms into the pupa stage, from which it emerges as an adult beetle (male or female). From the laying of the egg to the adult state occupies about six weeks in summer. The adult stage is lengthy, and the beetle is destructive, as well as an egg-producer. In cool districts there are about three generations in a year; in warm districts, six or more broods. Usually only one grub is developed in a wheat grain, but in maize three or four grubs may develop in a grain. Cool conditions retard development. Our commonest species, *Calandra oryzæ,* is a tropical and sub-tropical insect, and cool districts would be unfavourable to it; but *C. granaria* is equally common and destructive elsewhere in cold countries such as England, and may be expected to flourish in our cooler districts of New South Wales. Fortunately, this European species has been noted twice only in imported grain, so that our predominant species is still *C. oryzæ.* Some weevil-resistant types of maize may yet be discovered, which would mean an immense annual saving to our growers, and observations in that direction are being made.

Bee Moth.

With respect to bee moths, there are two species which have been introduced into Australia with bees. They are known as the larger Beeswax Moth (*Galleria melonella*) and the smaller (*Achrœa grisella*). This last species, besides attacking the comb, feeds freely on débris in corners and cracks in the hive. Both species commonly attack the comb of the black strain of hive bees, and more rarely those of the Ligurian strain.

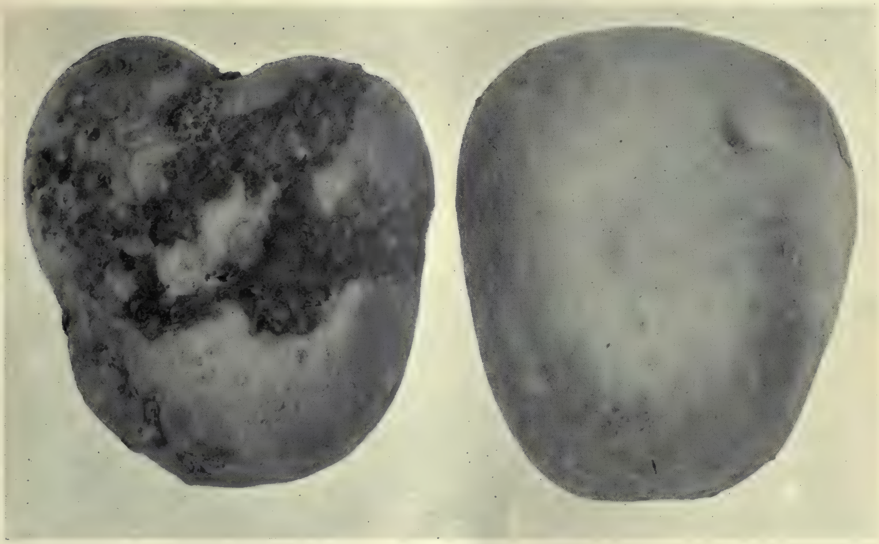
Potato Moth.

This is a small, light brown moth, suggestive of a clothes moth (both species belong to the family *Tincidæ*), and as some 2,000 odd species of this family have already been discovered in Australia, some confusion of species is readily possible. See illustrations opposite.

Cabbage Moth.

This moth (*Plutella cruciferarum*) is a shade smaller than the potato moth, and with yellowish, diamond-shaped markings on the back when the wings are folded. The moth lays eggs on cabbage leaves and stalks, and the grubs, hatching from these, feed on and riddle the leaves, then pupate within a tiny, silken cocoon, spun on the foliage. From the pupa the moth appears, and eggs are laid again and the cycle repeated.

A



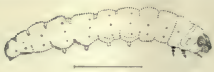
THE POTATO MOTH.

A—A potato showing traces of moth infestation on one side.

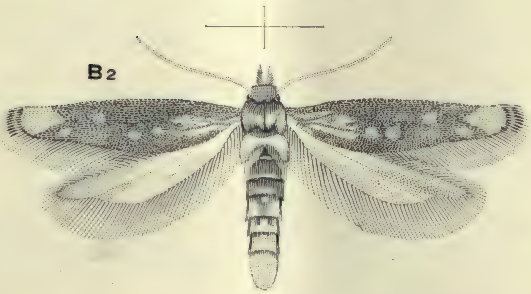
B1—The larva.

The lines indicate the natural size.

B1



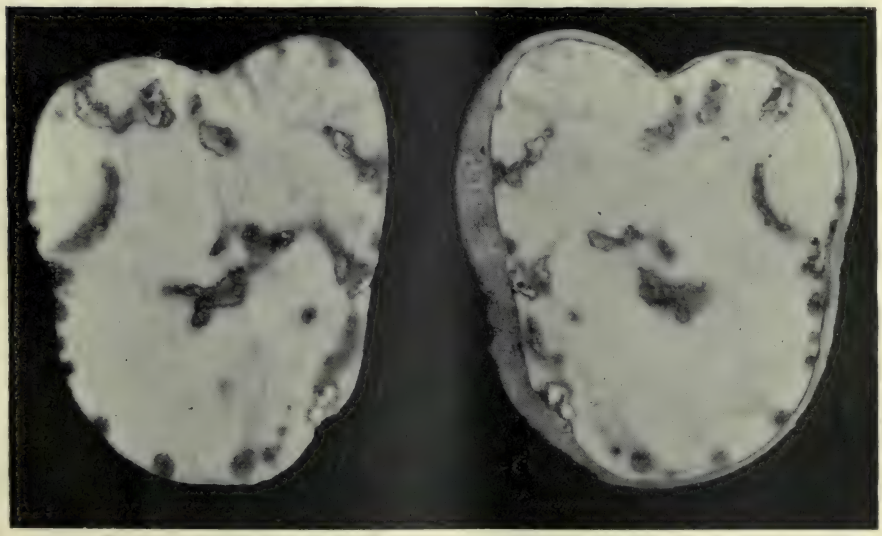
B2



B2—The adult Potato Moth.

C—The same potato cut open, showing how the larvæ affect the flesh.

C



The Dairyman's Cow.*

H. W. SWEANEY,
Manager, Williams River Co-operative Manufacturing and Butter Company, Ltd.

THE average dairy farmer's cow is too often a cow of any or every breed, no particular purpose being aimed at when purchasing or breeding, the price to be paid for the animal when buying being too often the main factor with many dairymen, instead of a desire to improve the quality of their dairy cows. Hence how often do we see a lot of our dairymen with cows that do not pay for the trouble of feeding or milking, and at the same time consuming as much feed, and taking as much, and even more, labour to milk, &c., as a much more profitable class of dairy cow. The dairyman keeps on breeding from these unprofitable cows, with a sire no better than themselves, in a vain endeavour to build up a dairy herd, and often wonders why it is that his neighbour, who has a better class of dairy cow, can always obtain a much better return per cow than he. He generally comes to the conclusion that the dairy company he is supplying is not giving him fair weights and tests, and he vents his anger on the manager of the particular factory he supplies. He makes no attempt to weed out his unprofitable cows, or to get a sire that will in time improve his herd, but plods away in the same old groove year after year. Luckily, this does not apply to all our dairymen. In some of our districts the dairyman is taking a keen interest in his dairy herd, as he recognises from experience that it pays him far better to keep a good class of dairy cow, and make money, than to plod away in the old groove year after year, and be little, or no better off at the end of that time. He recognises that progress is a great factor in every department of dairying. In some of our dairying districts cow-testing associations are springing up, and while the average farmer admits of the great value these associations must be to the particular district in which they are formed, it generally takes something startling to move him to ever join such associations. Another factor that most dairymen overlook (and which to them should be a serious factor) is the regulating of their cows. As a rule, their cows generally come in in a heap, no attempt being made to regulate them, consequently they all dry off about the same time, and the dairyman finds that when butter is a good price he has very few cows milking, and they are drying off.

Some Common Ailments.

The troubles of a dairyman's cow are many and various, and I shall deal with them in the following order:—Sore Teats, Cold in the Udder, Blind Teats, Calving Troubles, Hoven, Foot-rot, Scald, Lice in Cows, &c.

* Read at Co-operative Dairy Factory Managers and Secretaries' Association Conference, Sydney, June 21, 22, and 23, 1909.

Sore Teats.

Some cows are subject to this complaint and cause the dairyman a lot of annoyance when milking, on account of the motion of the hand irritating the affected part of the teat, and causing the cow to get fidgety and kick. Generally the trouble can be avoided or averted to a great extent by careful treatment, and the following recipe is an unfailing remedy, and should be kept ready mixed up by every dairyman :—

2 drams finely-powdered ox. zinc.
½ dram pure carbolic.
1 oz. benzoated lard.

The teats should be washed with warm water and soap after milking, thoroughly dried, and the ointment rubbed on the affected parts.

Cold in the Udder.

This is a very common complaint. Often the cow is milked in the evening and comes in next morning with perhaps one or more quarters quite hard, and bad milk in each quarter. This can be almost instantly relieved by simply lathering (after being milked out) with a good lather of Sunlight soap and cold water, thoroughly rubbed in, a remedy I have never known to fail.

Blind Teats.

This is generally caused by faulty drying of cows. All cows that are turned into what the farmer calls the dry paddock should be brought in regularly and stripped out, otherwise the milk remaining there goes bad, and chokes up the natural outlet. There are many devices on the market in the shape of milking tubes, &c., but my experience of them is, that they may work for a short time, but eventually that particular quarter will dry up; moreover, the greatest care is necessary in using these instruments, and they must always be thoroughly sterilised before using.

Calving or Parturition Troubles.

This is a complaint that is very common, especially with cows that are not in the best of condition. The cow gets rid of the calf all right, but fails to pass the cleanings; in such cases a cleansing drench should be used. I always use Dr. Ballard's drench, and find it invaluable. It is as follows :—

Cream of tartar	2 oz.
Powdered aniseed...	2 oz.
Powdered gentian	1 oz.
Powdered ginger	1 oz.
Sulphur	2 oz.
Epsom salts	8 oz.

Dissolve in 1 pint hot ale, which increases the effect, and stimulates heat in the stomach, and give when cool. This will invariably shift all cleanings.

If the above ingredients are not procurable, give 8 oz. Epsom salts dissolved in hot water, and allowed to cool, at the same time assisting the cleansing by hand.

Another trouble that seems to be getting more prevalent is dead calves in cows. This is usually caused by some strain, such as cows feeding in paddocks that have not been cleaned up, straining themselves jumping over logs, or a cow getting into a neighbouring farm and the dogs being used to help her out, when she usually goes through a fence, or has to jump over logs or rails; or a calf coming out the wrong way first and getting jammed. In the latter case, the first thing is to turn the calf round to the proper position, and, if not able to be pulled out by the hand, get a rope round its head and pull it out; if it does not come with a fair amount of force, which it should if properly turned, the best means is to get someone who understands the business to dissect the calf, and take it out in pieces.

Hoven.

This is caused by cows being allowed to feed too long on green lucerne, clover, trefoil, &c., and the usual method adopted for treating the complaint is by the use of a trocar and canular, sometimes an ordinary knife, which generally, if the animal is not too far gone, gives relief; but a much better remedy, which will not give any bad after effects of any consequence, and saves tapping the cow, is 1 oz. English oil of peppermint, 1 lb. Stockholm tar, 1 lb. bicarbonate soda; mix well together, open cow's mouth, pull the tongue well forward, and give two teaspoonsfuls, when the cow will receive instant relief, and suffer no after effects.

Foot Rot.

This is a complaint that is very prevalent during wet seasons, and is caused by the dirt drying and caking in between the hoofs of the beast; the lower part of the leg immediately begins to swell and gets very painful, the cow begins to fall away, both in condition and milk, and very often the toe comes right off. A very simple remedy which is used by many up-to-date farmers with absolute success is, equal parts of vaseline and boracic acid mixed into a paste. The cow is bailed up, put the leg-rope round the foot with the rot, and pull, and tie it up so as to get at it. Take a clean piece of linen, and work it backwards and forwards between the toes to clean out the dirt; when clean, paste the ointment in, a good thick layer; take a clean piece of linen, put it between the toes on top of the ointment, and tie round the hock, then let the cow go. This will only have to be repeated once or twice at the most, provided the rot has not developed to any great extent, and the cow will be quite well in a few days.

Lice in Cows.

This complaint is not very common, but when the cow is affected, dairymen find great trouble in ridding the cows of the pest. A very simple remedy—one bottle Jay's fluid mixed in a gallon of water, and well rubbed in, will soon exterminate them. Another complaint met with usually in hot weather is scald, particularly in cows which are inclined to be soft or tender skinned; a good remedy for this is cold water and eucalyptus soap well lathered, the

eucalyptus having a numbing effect, anything else used will cause an irritation. The above remedies I have found, from practical experience, to be unfailing, if properly applied.

Speying of Cows.

This is a subject that the average dairy farmer knows very little about, in fact, he does not at all connect it with dairying, and if he were told that it was a good method of weeding out his unprofitable cows he would perhaps wonder, but nevertheless, speying is an operation that every dairy farmer should make himself thoroughly acquainted with, as it is a well-known fact that speyed cows will put on flesh much quicker than otherwise, and a better price can therefore be obtained from the butcher on account of the extra weight, while the dairyman will not have to keep his cow nearly so long to get fat, consequently there is a considerable saving of feed. When I say speying for unprofitable dairy cows, I do not mean the old system of speying, where the side has to be opened up, the ovaries removed, then stitched up and tarred, running the risk of contamination by flies, and a considerable amount of inconvenience to the animal so treated, but the method now practised in some districts of speying from behind through the passage which gives little or no inconvenience to the cow treated, and which is a much more humane method. The cow is run into the bail or crush, an injection of antiseptic used, principally Lysol, the hand and arm inserted, an instrument used to bring the parts to be removed into position, a small lance inserted to slit the walls of the uterus to allow the ovaries to come through, which are then bruised off allowing no chance of inflammation and taken out, and the operation is complete. Of course, young stock cannot be treated in this way on account of the smallness of the passage, the operator not being able to insert his hand and arm, or cows gone too far in calf, as the operation would most likely result in the loss of the cow. I have known one man to spey by this method eighty cows in one day.

Diseases and their Treatment—Contagious Abortion.

A disease that is spreading throughout many of our coastal dairying districts. The symptoms of this disease are as follow:—An in-calf cow aborts and fails to conceive when put to the bull, or in some cases a pregnant cow aborts and the fœtus is not found and burnt; other cows of the herd finding and smelling it, if in any way affected with the disease, will abort in sympathy with the one already aborted; or if a dairyman knows he has abortion in his herd, and on milking a cow he knows is only some four or five months pregnant, finds the udder enlarged and a decrease in the flow, can be sure that if that cow is not treated she will also abort. Cows thus affected should be treated and isolated. The bull should on no account be allowed to run with the cows, as he will spread the disease to every cow he serves.

Treatment.

Some authorities recommend the use of a large cattle enema syringe or a tube with a glass funnel attachment at the end for pouring in the solution.

From practical experience, I prefer a small hand pump made expressly for the purpose; about 3 feet of rubber hose is attached to the pump, and a nickel-plated nozzle at the end; the antiseptic drug is mercuric chloride (corrosive sublimate). This drug is for such purposes put up in flat circular pellets, each containing a definite quantity, 8·75 grains; neither the drug nor its solution must on any account come in contact with plain metal on account of its strong chemical action on such material.

The strength of the solution of mercuric chloride to be used is as follows:—

(a) For cows which are repeatedly returning to the bull, or are apparently sterile, 1 in 1,250; this can be conveniently prepared by dissolving one pellet in an ordinary clear glass whisky bottle full of water, which has been boiled, and allowed to cool to blood heat.

(b) For a bull, a solution of the same strength should be used, the operator taking precaution to cut off any long hairs attached to his sheath.

(c) For cows which have just aborted, a weaker solution (1 in 2,500) should be used and applied once daily for three successive days, and at weekly intervals afterwards. If there be any discharge from the vagina, this solution can be made by dissolving one pellet in two bottles of water.

(d) For in-calf cows more than three months pregnant, which are to be treated as a preventive measure, the solution (1 in 2,500) as in paragraph (c) should be used, unless in case of an actually aborted cow.

The bull requires to be put into a crush or otherwise roped to a fence, his hind legs tied back; insert the nozzle of the pump into the sheath and hold fast while the pump is worked. It requires two to do the work successfully—one to hold the nozzle in, and the other to pump.

Be certain that the whole of the pellet is thoroughly dissolved before using the solution, as any undissolved particles lodging in the membrane of the vagina or womb would cause intense irritation.

In connection with this treatment, it is necessary to remember that the mercuric chloride is a highly poisonous drug, and every precaution must be taken. All bails, pumps, vessels, &c., must be thoroughly cleansed and disinfected after use.

Milk Fever or Parturient Apoplexy.

This is a disease responsible for a good deal of mortality in most of our up-to-date dairying centres where cattle of high-milking qualities are the rule. Many dairymen have lost the pet cow of the herd from an attack of this singular disease.

One striking but unfortunate feature of this disease is the attack is invariably made on the heaviest milkers in the herd, and seldom if ever is the attack made on a poor milker. Heifers in their first calf are rarely if ever troubled. The disease usually appears with the third calf, though the writer has known a cow to escape attack until the eleventh calf, and then succumb within a few hours after showing first symptoms. Once a cow

has had an attack she is always susceptible to the disease, and requires careful attention with each subsequent birth, lest she again falls a victim.

Until very recently the majority of cases have proved fatal, but since the introduction of *air treatment* many dairymen have been enabled to successfully combat the majority of cases without the aid of a veterinary surgeon. This wonderful treatment has been a great boon to many breeders of high-class dairy cattle and also to the industry.

This is a case where prevention is better than cure, and practical men have found the following to be of great significance, viz.:—About a week or ten days prior to the due date of parturition (calving) give a drench as follows: 12 to 16 oz. Epsom salts with small quantity of treacle and ground ginger; it is also recommended to keep the susceptible in sparse pasture for a limited time prior to and after parturition, especially cows in prime condition.

The object of the drench is to act as a bowel corrective; it also has the effect of thinning the blood, which latter is very essential.

As a rule the disease is contracted within forty-eight hours after parturition (and often following an easy accomplishment of same) and seldom occurring after a lapse of ten or twelve days.

In the case where a cow comes in with a large quantity of milk secreted, and the udder much distended, it is not advisable to draw off all the milk for the first few milkings.

The writer is of the opinion that if the above rule was adhered to, many cases that have proved fatal would have been prevented.

Symptoms.

As a rule the first symptoms are general uneasiness, kicking at abdomen with hind feet, staggering, and finally falling and groaning at intervals; breathing is erratic and apparently painful; while down, the head is constantly thrown back to the body, temperature falls below normal, cow loses consciousness, and if successful treatment is not speedily adopted death is inevitable.

Treatment.

On no account allow the cow to lie flat on her side, but keep propped up in a natural position by means of bags filled with straw or some such material. The Anderson apparatus for treatment consists of a metal cylinder with screws at each end, which can be removed for the purpose of filling the cylinder with sterile absorbent cotton impregnated with carbolic acid, or other medicated cotton. At one end is attached the rubber balls and tubing (practically the bellows); at the other end is attached a piece of rubber tubing a couple of feet long in which is inserted a nickel milking tube. Before using the pump place a sheet under the udder to keep it and the apparatus clean during the operation; then wash the udder and teats thoroughly with a weak solution of carbolic acid and warm water. If there is any milk in the teats it should be withdrawn. The milking tube is then (after a thorough sterilisation in a solution of 5 per cent. carbolic acid) carefully inserted up the milk duct of the teat; the quarter is then inflated, or pumped as full as possible.

In withdrawing the tube, care must be taken to prevent the escape of air by having an assistant to tie a piece of tape round the teat. The other three quarters being similarly treated, then knead and massage gently, rubbing from the bottom of udder upwards. If the cow does not show signs of improvement within a few hours repeat the treatment, using the same antiseptic precautions. When the cow is able to get on her feet and shows signs of speedy recovery the tapes may be removed. If the bowels and urinary organs have not acted, a good drench of Epsom salts and treacle, and small quantity of ground ginger added, is recommended. This, however, should not be attempted while the cow is down or in a semi-conscious condition, as there is a danger of the drench gaining access to the lungs and smothering the cow.

A very useful apparatus for the treatment of this disease can be constructed from an ordinary bicycle pump, by obtaining a metal cylinder about 3 inches long and a couple of feet of rubber tubing. The bicycle pump contrivance is an advantage by means of inflating the udder in much faster time than the ordinary outfit, but whatever style of inflater the operator may use, the main essential is to see that it is handled under strict antiseptic conditions.

The writer can call to mind an instance in which an inexperienced person undertook to inflate a cow, without taking any antiseptic precautions. The result was the cow recovered from the disease, but was of no further use for the dairy as the udder contracted mammitis, due from bacteria being pumped into the udder while administering treatment, hence the absolute necessity for treating under strict antiseptic precautions.

Passion Fruit Returns.

A Kurrajong orchardist reports that from 1 acre of passion vines he cleared £45 for the winter crop.

Babcock Milk Tester Demonstrations in Public Schools.

The demonstrations in the use of the Babcock Milk Tester inaugurated this season in the Public Schools throughout the principal dairy-farming districts have proved to be very successful. The South Coast dairy instructor reports that he has now carried out demonstrations in schools all over his district, and the interest is well sustained. On an average about 25 senior pupils in each school attend the demonstrations, and of these it is fair to assume that the majority become proficient in the use of the tester. Reports from other districts are equally encouraging.

Modern Dairy Instruction.

Dairy Science School at Lismore.

It is only a few years ago when itinerary dairy instruction was confined to demonstrations given in butter-making by a small churn and butter-worker. Wonderful strides have, however, been made in the dairy industry, and modern instruction, to be of any value, must cater for affording instruction, not only in the management of dairy farms, but also in the management of butter factories.

The New Departure.

Last year the Department of Agriculture undertook to give factory managers a couple of weeks scientific instruction; the centre chosen being the Berry butter factory. This year, however, the Richmond River district was chosen as affording the best place in which to hold such a school, and on this occasion considerable advance was made, even on last year's programme.

The Teaching Staff.

The teaching staff alone will give an idea of what the Department is aiming at, and, from the personnel of the staff, it will be seen that the Dairy

Group of Students and Departmental Experts at Lismore Dairy Science School, 1909.

Back row (left to right): Messrs. Brett, Houston, Kilgour, Bollar, Kennedy, McKinnon. *Third row:* Messrs Cochrane, Cox, McDermott, Elbra, Martyn, Johnson, Higgins, O'Connor, McElvine. *Sitting:* Messrs. Pedersen (Dairy Instructor), Stening (Butter Grader), Chapman (Dairy Instructor), (O'Callaghan (Dairy Expert), Fraser (Manager, Lismore Factory), Grant (Bacteriologist), Ramsay (Chemist). *Front row:* Messrs. Cummings, Laws, Searle, Taylor, Watt.

Branch does not believe in half measures. The staff is probably one of the strongest of its kind to be found anywhere, and it would be only in a very advanced dairy school indeed, that teachers of the same calibre would be warranted.

Mr. O'Callaghan, Chief Dairy Expert, attended as director of the school and lecturer, and he took with him Mr. Ramsay, Chief Assistant to Mr. Guthrie, Chemist, as an analyst; while Mr. Grant, from the Bureau of Microbiology, demonstrated bacteriology; Mr. Pedersen, Dairy Instructor, went on the cream stage and gave instruction in the grading of cream, and the making of a starter, etc., and Mr. G. Stening, Government Butter Grader, went in charge of the butter-making section. Thus the practical and scientific sides of dairying were thoroughly represented by men who should know every detail of their work.

About twenty managers and assistant-managers attended the course of instruction, and, as the whole question of butter-making was dealt with, both by lectures and demonstrations, and the scientific course of each process of butter-making thoroughly gone into, those who attended should benefit very considerably.

Probably most interest was taken in the bacteriological section; creams, waters, and butters, were daily examined for the purpose of giving the students some experience in the technique and general work of dairy bacteriology.

Among the factories represented at the school, were the Lismore branch of the North Coast Co-operative Company, the Byron Bay branch and the Tweed River branch of the same company, the Lismore Co-operative Butter factory, and Foley Bros. factory at Lismore, Kyogle Butter Factory, the Ballina Co-operative Dairy Co., Alstonville Co-operative Dairy Co., Dungog Co-operative Dairy Co., Ulmarra Co-operative Dairy Co., Maclean Co-operative Dairy Co., Candelo Co-operative Dairy Co., and others.

One of the great advantages which it is expected will accrue from this school will be that all those who attended will have obtained some uniform idea with regard to the grading of cream and the manufacture of butter, as all were working under one instructor in each section. It is also understood that many of those present will equip themselves with simple outfits so that they will be able to make a simple examination of butter and cream, especially the latter, from a chemical and bacteriological point of view. Thus our present managers are given an opportunity of bringing themselves up to date in the scientific side of the industry, and they will be in a position to hold their own with even young men who are going through the schools at the present time, when education in these things is not only cheaper but very much more easily obtainable. Ten years ago it would have been impossible to have got a training of this kind in Australia, so that it will be seen the Department of Agriculture has done a good deal for the benefit and advantage of New South Wales factory managers.

List of Students.

Name.	Address.
McIlveen, L.	Bowthorne Co., Hinton.
Cumming, B. C.	Ballina R. and P. Co.
Cox, H. J. E.	Do do
Searl, Geo.	Dungog Co-operative Co.
O'Connor, C. R.	Kyogle Co-operative Co.
Houston, J.	H. A. College.
Johnston, W. T.	Clarence River Co.
Kilgour, D. D.	Nobby's Creek, Murwillumbah.
McKinnon, W....	Cathcart-street., Lismore.
Boller, E. T.	Clarkson's Crossing, Candelo.
Brett, F. E.	"Ridgewood," Lismore.
Watts, Alex.	Alstonville Co.
McDermott, J. P.	c/o The Creamery, Alstonville.
Higgins, A. R.	Co-operative Dairy Co., Maclean.
Fraser, C. H.	Lismore.
Martyn, S.	Murwillumbah Factory.
Kennedy, A.	Byron Bay.
Taylor, A. A.	Lismore Co-operative Dairy Co.
Laws, S. F.	Foley Bros. Factory, Lismore.
Elbra, C. P.	N. C. Dairy Co., Lismore.

System of Instruction Employed at the Dairy Science School.

The school was held in the Lismore branch of what is best known as the Byron Bay Co-operative Dairy Company. The factory is a modern one and contains every improvement which is shown to be of advantage. The directors kindly placed the factory at the disposal of the Department of Agriculture for two weeks, and the managers of the district and other factories gladly availed themselves of the opportunity afforded. Twenty students were enrolled, and an outline of the day's work is given below:—9 a.m. till 10·30, lecture to all, by Mr. M. A. O'Callaghan; the class was then divided into four sections: one section went with Mr. Pedersen and devoted themselves to practice in the grading of cream, and practice in the making of a "starter," or ferment for ripening cream. Another section went into the butter-making room and were taken in hand by Mr. Geo. Stening, who discussed with them the various processes of butter-making, and gave each individual practice in same. The third section went to Mr. Grant, the bacteriologist, and received a preliminary lesson in the ordinary laboratory technique necessary for the cultivation of germ life. The fourth section went to the chemist, Mr. Ramsay, and from him received a lesson in elementary dairy chemistry, and were afterwards given practice in the use of a chemical balance, and in the determination of water in butter and other special dairy work. Probably the most interest was shown in the bacteriological work, and the creams which were selected by the Cream Grader, and by the Dairy Expert, were daily examined with a view of showing the students the difference between a good cream and a bad cream from a bacteriological point of view. Experiments were also carried out in the contamination of cream and water, so as to show the students how easy these

substances may be contaminated and made unfit for the manufacture of a high-class butter. In the beginning there was a wonderful difference of opinion between the students individually as to what constituted a first-class cream, and the grading of the cream showed such variations that it was at once evident considerable attention would have to be devoted to this point. At the end of the term an examination was held which showed that on the whole the students had made very considerable progress in this question of cream-grading. The creams selected for the examination were carefully picked by the Dairy Expert and his assistants, Messrs. Pedersen and Stening, who decided on a certain number of points for each cream, and then allowed each student to classify the several cans of cream independently; an examination was also held in the testing of milk and cream, and those who passed in these examinations will be given certificates to that effect.

Mr. Chapman, the District Dairy Instructor, generally assisted at the session, and of course took advantage, at the same time, of acquiring any further knowledge he could in subjects such as bacteriology. The Chief Dairy Expert went from section to section during the day, and kept the students in touch with their work right through, so that those who were weak in any one branch were given as much work as possible in that section.

At the end of the session there was a smoke social, and managers testified to the value of the instruction which they had received. A desire has been expressed by representatives of the northern factories that a summer school of, say, one week in length should be held in Lismore next season, so that the students would be given an opportunity of seeing the advantages of bacteriological work to the industry during the most trying part of the year.

Dairy Science School at Tamworth.

The third Dairy Science School for Factory Managers was opened at Tamworth on 16th August, 1909. This centre was chosen as being about midway between the New England and the Hunter districts. The factory of the Tamworth Co-operative Dairy Company was placed at the disposal of the Department of Agriculture for the school, which lasted for a fortnight. The Dairy Expert, Mr. M. A. O'Callaghan, undertook the general direction of affairs, and he was assisted by the same staff as in the case of the science course at Lismore, reported above. The factory managers availing of this opportunity of special instruction in the branches of science which apply to modern dairying came from Tamworth, Glen Innes, Armidale, Raymond Terrace, Jindabyne, Muswellbrook, and other centres.

Cheese-making for Farmers who send their Milk to Sydney.

W. GRAHAM, Instructor in Cheese-making.

THE Illawarra, Camden, and Penrith districts supply the largest portion of the fresh milk needed for the wants of Sydney and suburbs, and, taking into consideration the conditions which exist, I think there are many cases where a farmer could make cheese on his own farm, and also be a Sydney milk supplier as well. The farmer who sends his milk to Sydney is paid a good price for all the milk he delivers there in good condition, but when seasons are good and the supply abundant, he has certain days through the week, including Sundays, when his milk is not taken. These are called "stop days," and may occur once a week, twice a week, or even three days a week, according to the supply and demand in the city. In warm weather, the night's milk is refused also. This rejected milk has to be separated; the cream only is taken; he is paid for his cream according to the market price of butter, less working expenses. His position is thus one of uncertainty. He does not know how many calves or pigs he can rear, if indeed he can rear any; and judging by the low prices that yearling calves have brought lately, it is questionable whether it pays him to rear them at all, unless a few heifers from his picked cows, for keeping up his herd. If he receives 8d. per gallon for the half of his milk which he sends to Sydney, the other half, when working expenses are deducted, does not realise him more than 3½d. per gallon.

Now, assuming that he makes the latter half of his milk into cheese, the question would be raised, would it pay him? A certain South Coast Co-operative Cheese Factory, although the Sydney market is reported dull, paid suppliers for the month of June 1s. 4½d. per pound for butter-fat. This would work out to a trifle over 7d. per gallon for milk. Is it not worth considering? A farmer who milks from eighty to one hundred cows could increase the profits of his herd considerably. He would, certainly, be put to the expense of building a dairy and cheese-room, and installing a small cheese plant, but this additional expense would be cleared off by the extra profits in six months. The next point raised would be the extra labour. It takes six hours to make a good cheese; now, where a herd of eighty to one hundred cows are milked, there are always four or five milkers, one of whom could be entrusted with the duties of cheese-making. On the other hand, if a farmer employed a skilled maker, his milk could be made up for 1d. per pound at the outside. The above-mentioned Co-operative Cheese Factory's expenses were 1½d. per pound. There are a number of farmers in this State who make cheese on their own farms whose expenses are even less than that. The 1½d.,

of course, includes freight, commission, &c. Some farmers have small dairies and steam boilers, by which they do their separating. In these cases the expense would be considerably lessened; all that would be required would be a vat, a press, a curd mill, a few cheese-hoops, and a pair of curd knives, and the fitting up of a cheese-room would complete the whole outfit.

It is sometimes a good thing to have two strings to one's bow, and, considering the good prices that have been obtained these last few years for cheese, I think the project is well worth careful consideration, and would prove a profitable one to farmers engaged in the Sydney milk trade.

Farmers should also realise that that they may at any time obtain practical guidance from the Dairy Branch of the Department of Agriculture on all points connected with such an enterprise.

Citrus Fruit from South Coast.

Mr. G. A. Jones, of Bomaderry, submitted a collection of thirteen varieties of oranges, mandarins, and lemons, grown by him. The fruit was all rather thick-skinned but of exceptionally healthy appearance, and served to illustrate what can be done in fruit culture in the South Coast.

Unduly Heavy Battens on Lucerne Hay Bales.

For some time past complaints have been made concerning the practice of some farmers who use in baling up their lucerne hay unduly heavy battens. Mr. C. W. Bowyer Smith writes: "I am feeding a herd of cows on lucerne hay. The battens used in the 14 bales (gross weight 42 cwt. 3 lb.) which comprised my last consignment, weighed 3 cwt. 46 lb. I paid £4 5s. a ton for the hay at gross weight, so that the battens cost me 13s. 9d. Before I have done feeding, I estimate battens will have cost me not less than £4." Mr. Bowyer Smith adds that he has found in the hay masses of thistle and other foreign matter, and expresses the opinion that all dairymen would be grateful to have legislation on these matters.

Mr. A. D. Playfair, of Randwick, in a letter to the *Sydney Morning Herald*, concurs with Mr. Bowyer Smith, and complains that, in addition to the unfair use of heavy battens, he has purchased bales of lucerne which, on being opened up, were packed full of barley grass and in some cases pure straw in the centre.

The question of unfair packing of fodder has been under the consideration of the Minister of Agriculture, and Mr. Perry says he proposes to deal with the alleged evils by legislation.

Grading Butter.*

Tampering with Certificates.

R. CROWE, Superintendent of Exports, Victoria.

The criticisms of grading are becoming more kindly as time goes on. From the prices secured by individual factories, per the various steamers, it is found that they have in every instance, so far as particulars have been available, coincided with the grades of the butter. The very few criticisms made at home and abroad have, upon investigation, in every case vindicated grading. Early in the season a most serious complaint was received to the effect that a brand of butter with a first-grade certificate had turned out in second-grade condition. On looking into the matter, it was found that four parcels of the brand referred to were shipped by this steamer, two of which were of first and two of second grade quality. The second-grade parcels, however, were qualified with a distinctive mark. The Department cabled the Agent-General to secure the certificates which were used in connection with the sale of the parcel. The two first-grade certificates were procured, but the two second-grade certificates were not available, and the Agent-General reported that no certificate number was discernible on the boxes complained of. In view of all the circumstances, it was evident that sharp practices had been indulged in, and an attempt made to throw the blame on the graders and the grading system. It is simply remarkable how slow people at the other end are in recognising the necessity for always identifying the certificate number branded on the packages with the number on the certificates. Probably it is because the number marked on the packages forms such an insignificant portion of the brand employed. It is meaningless unless the certificate is produced. This raises the question whether the time has not arrived when all packages should bear a grade-mark. In the absence of a grade-brand the difference between a 91 butter and a 89 butter is of little consequence, and this holds good with a 95 or a 94 butter. If the standards already fixed were applied to all packages, managers would be able to grade their cream and thus classify their butter. I venture to say that if the grading system had been applied in its entirety during the last few years Victorian export butter would have been on a very different plane from what it is on to-day.

Bulletin on Ensilage.

A reprint of Bulletin No. 6 on Ensilage is now available for free distribution on application to the Under Secretary, Department of Agriculture, Sydney.

* Extract from Address, "Review of past Dairying Season," at Factory Managers' Conference, May, 1909.

Excessive Moisture in Butter.

At a meeting of the Provision Trade Section of the London Chamber of Commerce on 11th May last, it was decided to submit to the representatives of the Australian States and New Zealand the following representations in regard to alleged excessive moisture in butter, and to express the hope that the matter might be brought under the notice of the Governments of the respective States:—

"In past years, until quite recently, the imports of butter from Australia and New Zealand have been increasing, and, generally speaking, it has obtained a high reputation for reliable quality and dryness, the moisture seldom exceeding 14 per cent.

"Since the passing of the English Act, under which a limit of 16 per cent. moisture is allowed in butter, several instances have occurred in which persons dealing with Australian and New Zealand butter in the United Kingdom have been fined for selling butter containing more than the 16 per cent. limit.

"In view of the reliable reputation previously gained by Australian and New Zealand butters, the Provision Trade Section of the Chamber consider it most unwise that, for the sake of a small gain in weight by the addition of water up to and exceeding the limit, the manufacturers in the colonies should risk their reputation and eventually cause a general decline in value.

"In order, therefore, to protect the best interests of the manufacturer, and also those of the merchants and consumers in this country, the Section considers it highly desirable that the Governments of the various Australian States and of the Dominion of New Zealand should exercise special supervision over butter produced in those countries, and should specially test any which is known to be produced for export.

"In the absence of any precaution of this character, the reputation and price may speedily decline, with disastrous results to the producer, the merchant, and consumer.

"KENRIE B. MURRAY,
"Secretary.

"Oxford Court,
"Cannon-st., London, E.C."

The Agent-General, in transmitting these representations, states:—"I have brought this communication under the notice of my butter expert, who reports that so far as New South Wales butters are concerned it very seldom happens that the amount of moisture exceeds 16 per cent., and, as a matter of fact, during the season just closed, he had only one complaint from a buyer, and when the latter was asked to return the butter for analysis he declined to do so. Although our butters compare very favourably in this regard with any others reaching the London market, the butter expert intimates that occasionally consignments come forward showing more moisture than is desirable, and I am of the opinion that manufacturers cannot exercise too much care on this particular point."

The Dairy Expert, Mr. M. A. O'Callaghan, reports:—"Of the butter exported from this State from 1st July, 1908, to 30th June, 1909, 185 samples of butter were examined for the purpose of ascertaining the water-content, and only seven were found to be in excess of 16 per cent.

"The following table will show the percentage in the samples examined:—

10 % and under.	Over 10 % and under 12 %.	Over 12 % and under 14 %.	Over 14 % and under 16 %.	Over 16 %.	Total.
1	35	87	55	7	185

"The maximum amount of water found in the samples was 18·48 per cent., and the minimum 9·22 per cent.; the average of the whole being 13·30 per cent."

STACK ENSILAGE ON THE NORTH COAST.

IN December last, Mr. Spencer M. Cottee, of Belvidere, Tregeagle, reported that with the object of giving ensilage a fair trial on his dairy farm, he had put in 12 acres of broadcast maize, which under anything like favourable conditions, would yield from 130 to 150 tons of greenstuff for ensilage and be a sufficient trial lot, at any rate, for any ordinary dairyman.

Mr. Cottee asked that Mr. Alexander, Manager of the Wollongbar Experiment Farm, might be allowed to attend to supervise the operations by cutting, carting, and stacking the fodder, and undertook to advertise the arrangements so that all the neighbouring farmers who cared to be present might participate in the practical demonstration. The Manager of Wollongbar Experiment Farm was accordingly instructed to visit Mr. Cottee's place and instruct the assembled farmers in the preparation of silage. On each day a large number of farmers turned up, and the children from the local school were also invited to come out for a lesson in ensilage.

In a letter dated 30th June, 1909, Mr. Cottee says:—"The silage is, I should think, as good as can be made. The cattle eat it ravenously, and through trimming and using the trimmings we have minimised the outside loss to 3 inches on top and 6 or 7 inches on the sides and ends. I cannot close without expressing my sincere thanks for all the trouble Mr. Alexander went to to make this a success."

Now is the time for dairy farmers to think about providing for the winter requirements of their cattle. Ground can be prepared at this time of the year, and maize sown either in narrow drills or broadcast for ensilage. If farmers do not feel competent to put up the forage successfully themselves, the Minister of Agriculture will be only too happy to place an expert officer at their disposal when the crop is ready. The solitary condition imposed is that anyone availing of the services of the expert is expected to invite his neighbours to come around and share in the information that is imparted.

In many districts it will be mutually beneficial if groups of farmers can arrange among themselves to help each other in the cutting, carting, and putting up of silage, as a number of Tumbarumba folk did recently.

Government Stud Bulls available for service at State Farms, or for lease.

Breed	Name of Bull	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Pansy Duke ...	Earl March ..	Pansy 4th ...	Wollongbar Farm.	*
,, ...	March Pansy ...	Earl March ..	Australian Pansy	Grafton Farm ...	*
,, ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd.	Berry Farm ...	*
Jersey ...	Thessalian II ...	Thessalian ...	Egyptian Princess	Alstonville ...	*
,, ...	Golden Lord ...	Golden King ..	Colleen ...	Wagga Exp. Farm	*
,, ..	Sir Jack ...	Omelette's Pride	Lady Tidy 3rd (imp.).	Berry Farm ...	*
,, ..	Berry Melbourne	Melbourne ...	Rum Omelette	Mt. Irvine, Bell ...	*
Guernsey ..	Gentle Prince ...	Rose Prince ...	Gentle ...	Alstonville ...	19 Jan., '10.
,, ...	Prince Edward..	Rose Prince ...	Vivid ...	Wyrallah	13 May, '10.
,, ..	Star Prince ...	Calm Prince ...	Vivid ...	Alstonville District	17 Dec., '09.
,, ...	Prince Souvia ...	Vivid's Prince...	Souvenir ...	Wollongbar Farm.	*
,,	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Paterson District	22 Oct., '09.
Red Poll ..	The Judge ..	Barrister ...	Lovely 8th ...	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General... ...	Judy 9th ...	Bathurst Farm ...	*
,, ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
,, ...	Auchenbrain Spicy Jock (imp).	Howie's Spicy Robin.	Another Mayflower	Berry Farm ...	*
,, ...	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
,, ..	Jamie's Ayr ..	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
,, ...	Emerald's Mischief.	Prince Emerald	Miss Prim ...	H.A.College, Richmond	*
,, ...	Dado	Daniel	Dot	H.A.College, Richmond	*
Kerry	Bratha's Boy ...	Aicme Chin ..	Bratha 4th ..	Glen Innes Farm..	†
,, ...	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Dexter Kerry	Waterville Punch.	....	.. ..	Grafton Farm ..	*
Holstein ...	Obbe II ...	Obbe	La Shrapnel..	Wollongbar Farm	*
,, ...	Hollander ...	Bosch III ..	Margaretha ...	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

Wool Tops

Trade with China and Japan.

Mr. Suttor, the Commercial Commissioner for New South Wales in the East, reports, under date 31st May, 1909, that considerable attention is now being paid to Australian wool and woollen tops, not only by the Japanese, but also by the Chinese. On the 30th May, 1909, the Osaka *Asahi*, one of the leading papers in Japan, had a special article pointing out the necessity of developing trade with Australia, by reason of the geographical position of the countries. Similar articles have also appeared in some of the Chinese papers.

In wool, the prospects appear to be very bright, more especially in the matter of tops. Now that a start has been made in the preparation of tops, Mr. Suttor urges that New South Wales woollen factories should make every endeavour to secure the markets of Japan and China. At present, the importations of tops to Japan amount to about £450,000 per annum; but there is every reason to believe that this will considerably increase in the near future. Now that two mills are working in China, there is no doubt that once they know that tops can be obtained from New South Wales, they will import, just as the Japanese intend doing.

In the past, great difficulty has been experienced in obtaining the necessary samples for distribution among the various mills in the East. It would be a great assistance to the Trade Commissioner if the leading wool-growers or salesmen could be induced to furnish good samples of all grades of our wool, so that the merits of the staple product of the State may be placed before Eastern importers and manufacturers in a thorough and proper manner.

For the information of the very large numbers of persons interested in wool-growing who may be at a loss to understand the distinctions made by the top-maker in the preparation of wool for manufacturing purposes, the following article by Mr. S. B. Hollings, of Calverley, Yorkshire, an acknowledged authority on this and all matters concerning the treatment of wools, is reproduced, with illustrations, from the *Pastoralists' Review.*

WHAT ARE TOPS? OR, HOW QUALITIES OF WOOL ARE DEFINED.

Evidently the question of "tops" is to the vast majority of woolgrowers Latin and Greek, and the term so familiar in consuming centres is as clear as mud in a wineglass to a large number of people handling the raw material in wool-growing areas in Australasia, South Africa, and South America. The following is a fair sample of numerous letters I have received during the last twelve months:—"I am in the office of a wool warehouse, and am anxious to learn the definition of 60's, 50's, 40's tops, &c.; our wool-classer cannot explain same to me. I have posted you under separate cover four samples,

and would like to know which are 40's, 50's, and 60's, and any other information without troubling you too much." That letter no doubt comes from a young man anxious to learn more of the wool business, and it is typical of the same sentiments expressed by scores of others who are even in more responsible positions. I am afraid that those who do know qualities in the colonies are too big in spirit in many cases to spend an hour with the future generation of growers, classers, and sellers of the raw material, but I hope that wherever it is possible young men will attend the various technical classes available in various centres in Australasia, and go with the determination to learn all they possibly can. For, after all, a practical demonstration is worth infinitely more than a lot of book reading, some of which is written by those who have precious little knowledge of the practical side of the wool trade. I would ten times rather read after a plain, matter-of-fact man without literary polish than after one who has but a superficial knowledge of the subject of wool.

Wool Sorting.

The first process which wool encounters when it arrives at a Bradford woolcombing establishment is that of sorting, and at illustration No. 1 the reader has a fair idea of how the operation takes place. The method of classing wool on a good station in Australia has to a large extent minimised the work at this end, and this operation is not so minutely done as it once was, although plenty of firms sort just as carefully and as thoroughly as ever they did. That, however, is the exception and not the rule, for Bradford woolsorters could tell a fine tale of the "bull mucking" operation which is a daily occurrence at every woolcombing place in Bradford. When a bale is open and its contents are fairly true and uniform as to quality, and there is on the fleeces no stained britch and nothing that seems irregular, the whole bale is soon despatched down the trap on to a pile that is being got ready for combing. However, that cannot be called good business at the best of it, and 75 per cent. of the present controversy over vegetable matter in wool could be dispensed with if woolsorting was done more carefully at this end. Let me say candidly that the workmen are not to blame, for being paid so much per pack (240 lb.) for sorting, they naturally want to make a decent week's wage, and they pick out, as a rule, what objectionable matter they see on the surface. However, that is only a side issue. At all our topmaking establishments woolsorting is done on a fairly large scale, and at the best firms every fleece out of every bale is carefully looked over and sorted for quality as well as length of staple. I will deal only in this article with the sorting of Merinos, leaving crossbreds to some future occasion. Now the majority of firms who makes 60's tops also produce 64's, 70's, and up to 80's quality. The wisdom of this is seen in the fact that as every woolgrower knows if a flock is essentially good standard 60's, there will be certain sheep that will grow a trifle finer fleece, say 64's, others may reach 70's quality, consequently for a topmaker to make the most out of that bale his sorter will carefully consign to their respective baskets these different qualities of wool. Every woolsorter, as our illustration shows, is surrounded by three, four, or five little skeps or baskets, and as he handles the fleeces he separates each one, tearing off certain portions which are finer than the rest, carefully allocating the same to that basket, which when full is passed by the foreman sorter or overlooker, and is then deposited on to the pile where it should go. Even a fleece of wool is oftentimes much finer at the shoulder than at the britch, and while the best part of the fleece will go into 64's, yet possibly the britch is only fit for an ordinary 60's, and if the neck portion has been left on, that, too, may only be fit for super 60's. Here comes in the work of the sorter and the classer, hence it is absolutely essential that even the colonial classer should

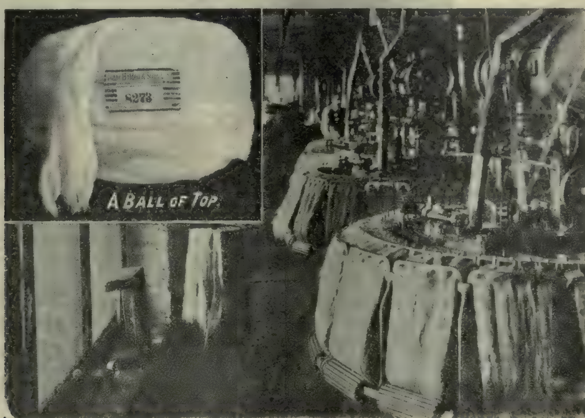
No. 1.—Wool Sorting.

have a practical knowledge of how to tell the different qualities of wool. I must admit that to put this into plain English is going to be rather a difficult job; still, I will try, though the work would be much more easy and more satisfactorily done if we had a fleece and I could tell readers which quality was 60's, 64's, or 70's, as the case may be.

Estimating the Quality.

Quality is simply the word employed in defining the fineness of fibre, and when we say certain wool is of 60's quality, it conveys the meaning that the wool in question should spin to such a length or smallness of yarn that it will take sixty hanks, each hank measuring 560 yards, to weigh 1 lb. of spun material. This, bear in mind, is not 1 lb. of greasy wool, but 1 lb. of clean scoured combed top. Now, how to tell the uninitiated which is 60's, 64's, 70's, and 80's is where the difficulty arises. It is all a question of judgment by the eye, and to some extent the rule of thumb. Even men's estimates vary somewhat in defining quality, some topmakers calling their tops 64's, while other spinners will only call it super 60's. The biggest firm of topmakers in Bradford produce what they call a warp super 60's, but it is equal to the majority of other topmakers' 64's, and they have made for that top 25d., which is to-day's price for the 64's of other firms. Now 60's wool is considered to be the beginning of Merino counts, and anything below that, such as 58's, 56's, and 50's, ranks as crossbreds. If the reader will carefully take out of a dozen separate Merino fleeces, say a staple out of each, and lay them side by side, he will in all likelihood see a marked difference in the fineness of the fibre. Probably he will have among those dozen staples 60's, 64's, and 70's quality, and if he sees no difference, then let him write to either his woolbroker or else to a neighbouring grower, whom he knows, and ask him for a few staples. It is only by comparison of what one may call ordinary Merino which will be 60's, medium to fine which will be 64's to 70's, and fine to superfine which will be 70's, 80's, and 90's, that any woolgrower can learn what are the different qualities of Merino wool.

At illustration No. 2 there is given a photograph of a combing machine, and the reader can see clearly the combed sliver which is called tops. In the upper corner is a sample

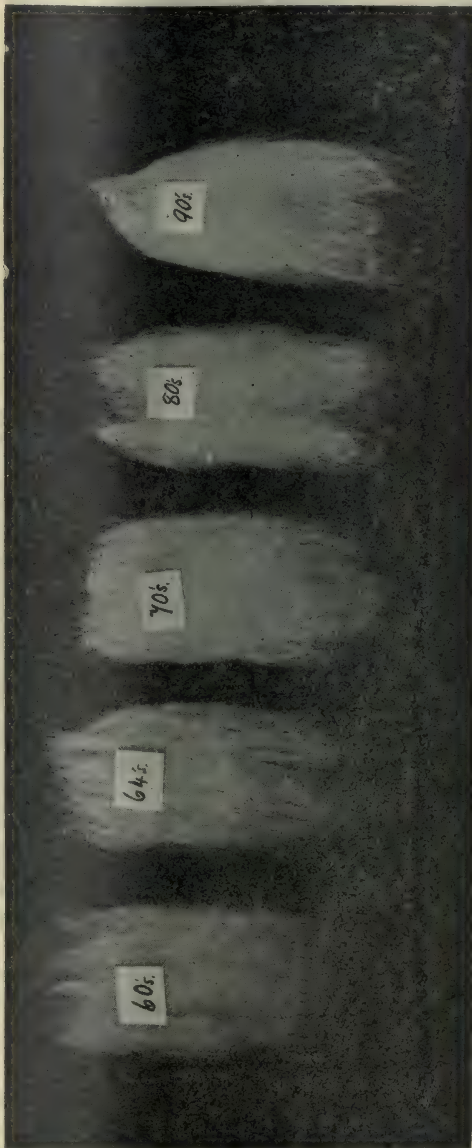


No. 2.—Preparing the Tops.

ball of tops after it has come from the balling machine, this top in question being 70's warp, or, in other words, a good length of staple when drawn. At illustration 3 we have different qualities of tops when "drawn." If the reader will carefully notice this illustration, he will see that the 60's drawn top is a little longer than the remainder, the staple as a rule getting shorter as the quality rises. Every practical woolgrower knows that sheep, say, of the Mudgee type, where quality is dominant, never grow the length of staple that we see in Riverina wools, simply because the quality of the latter, which will be 60's to 64's, is much lower than the former, which often runs up from 80's to 90's. A very close examination of the illustration 4 will perhaps reveal the fact that the fibre is nothing like as fine in the 60's as the 70's, while the fibre in the 90's quality is still very much smaller. In classing wool the operator has to see that his qualities are uniform,

and this can only be done by practice. No matter what the quality is, see that the fleeces harmonise as near as possible, and if he comes across different fleeces which he is convinced are finer than the rest, then he can be assured that he is doing his work satisfactorily if he puts these into their own individual class. In breeding circles we now get what are called strong, medium, and fine Merinos, but I cannot accept so-called 58's Merino as being in the category of Botany or Merino wools. Strong Merinos are essentially, or should be, 60's wool, medium Merinos 64's to 70's, and anything above 70's can be called fine Merinos, with 80's, 90's, 100's, and upwards superfine. All these are good in their place, and only a fool will disparage any one quality; in fact, the varied qualities of wool from 28's to 90's serve a useful purpose, and men purchase these for the purpose to which they are best fitted. The word "tops" is simply the combed fibres of wool laid parallel by the combing machine, the short fibres called "noils" being separated in the combing operation, and both tops and noils are commercial units and standards of the entire wool business both in England, on the Continent, and in America. As the qualities rise, so does their market value, for whereas to-day super 60's can be bought at 24d., 64's are worth 25d., 70's 26½d., 80's 28d. to 29d., and 90's 31d. to 32d. This shows their commercial value, and also the importance of qualities being kept separate by the topmaker.

Illustration No. 4 is perhaps as instructive as any to the average reader unaccustomed to the top grade. Here we have a super 60's and 40's crossbred top drawn by the hand, and it gives a very good idea as to the length of the staple. The Merino is about 3 inches long, and the 40's measured about 11 inches. From these two staples the reader can see at once the difference in the fineness of the fibre. Naturally the 50's is very much coarser than the 60's, 40's being considered as about the standard of the crossbred trade, and 60's the standard of Merinos. Good half-bred wool should scale from 50's to 56's quality, quarter-bred, say, 56's to 58's, or very fine crossbred; three-quarter bred on the longwool side, 46's to 48's; crossbred about a 40's, and a pure Lincoln 36's to



No. 3.—Different qualities of Tops when "drawn."

No. 4.—A 40's and 60's quality of Tops, showing difference in length when "drawn."

40's. I mention this to show the reader the difference between Merinos and crossbreds, and I shall deal more fully with the latter when I come to speak about crossbred tops and their qualities. Unfortunately with topmakers mixing their blends so much with Cape, River Plate, and God only knows what, a 60's top will not spin to fully 60's counts, but still that is the standard of the trade, and a pure Australian top of good length is the top that is understood as a standard super of 60's when it will spin to that length. I wish I could more clearly show the uninitiated how to define the various qualities of Merinos, but that can only be done by close observation and practice. Let nobody stick fast It is a most interesting occupation to start gathering wool samples, and everyone taking an intelligent interest in the different qualities of wool should try and obtain one way or other a standard collection of wool samples ranging from 36's to 90's. I would suggest to the heads of the different technical colleges where wool classes are conducted the handing to all students a book where three or four staples of all the qualities should be fastened in, for this will then in after life prove to be a standard to work to both by themselves and other people.

Tanyard Refuse as Manure.

A correspondent has brought under notice some tanyard refuse which he contemplates using as manure for his orchard. The Chemist, Mr. F. B. Guthrie, analysed the substance, which contains :—

Moisture	27·55	per cent.
Volatile	44·73	,,
Containing nitrogen 3·11, equal to ammonia (NH_3) 3·77.		
Insoluble matter	2·12	per cent.
Oxides of iron aud alumina ...	2·20	,,
Lime (CaO)	19·00	,,
Phosphoric acid (P_2O_5)	0·29	,,
Potash (K_2O)	0·68	,,

Mr. Guthrie considers that this tanyard refuse has a distinct manurial value on account of its nitrogen, and it would be of special value in sandy soils or soil low in organic matter. It would be necessary to grind the refuse as finely as possible, and in a finely ground state its manurial value, based on the unit-value of nitrogen, would be about £2 5s. a ton.

Extensive Tomato Culture.

W. B. DOUGLAS (Ex-student of Hawkesbury Agricultural College), Richmond.

TEN years ago the tomato was regarded as a garden crop pure and simple in this district, and very few people grew it. Since that time, however, the tomato has increased rapidly in favour as one of the surest and most profitable of small farm crops. When it is realised that the Sydney market consumes between 2,000 and 3,000 tons of tomatoes annually, some idea may be formed of the extent of the industry at the present time. The greater bulk of this is used by the various factories in making jam and sauce, approximately, 1,600 tons being utilised in this manner. The balance is disposed of through

A 9-acre Tomato Plantation at Richmond.

Belmore markets for household consumption. I cultivated tomatoes on rather an extensive scale last season, and as it was in connection with the sauce industry that I was particularly interested my remarks will be confined to that section of the trade.

At the beginning of each season the different jam and sauce manufacturers let out contracts for the tomatoes they will require during that season. One firm alone deals with over 400 tons annually, and lets out contracts for about 50 tons to each man willing to supply. The contract is only binding to a certain point. If the season turns out unfavourable, and the grower cannot supply the full amount, no attempt is made to compel him. On the other

hand if a man grows the tomatoes and tries to dispose of them in a more profitable direction he will certainly be brought to book. The contract price for the past season was £3 10s. per ton delivered in trucks.

As nothing is gained by getting early tomatoes the seed need not be sown till all danger of frosts is over. Seed sown in September is likely to escape frosts, and at the same time will come on better than the earlier-sown beds. The Burwood Prize stands easily first in this district as the best all-round tomato we have. It is a sure and even cropper, a good carrier, and what is very important also a most vigorous grower. During the very hot scorching days of December and January the fruit will scald very badly unless well protected by the foliage, and this is one reason why the Burwood Prize is so popular.

One ounce of seed is sufficient to sow 2 acres, if it germinates well.

I always prefer sowing the seed in shallow drills about 9 inches apart, as it facilitates watering (when necessary), and the weeding can be accomplished more expeditiously.

Owing to the continued frosts in 1908 planting was not started till the second week in November. The ground on which the bed was planted was 9 acres of a rich black alluvial, which had been cultivated to a depth of 9 inches. As no rain had fallen for some considerable time, it was necessary to water the plants as they were put in. Drills were opened out 6 feet apart, and small holes were dug every 6 feet along the furrows for the plants. About 1½ pint of water was put in each hole before the plant, which was just pushed into the mud, and some soil pulled round it. Out of about 15,000 plants put in, the loss in transplanting was not 5 per cent., so it will be seen the above method is effective, despite the unfavourable season. A man with a team of horses and two boys can water and transplant about 1 acre of tomatoes per day. This includes digging the holes for the plants, but not the drilling. If the weather is at all favourable, the plants will want cultivating in at least a month's time, and a week or two later will require hilling. I find it better to turn two furrows to the plants, and then clean out the intervening spaces with a cultivator. The plants very soon spread all over the spaces between the drills.

The crop started to ripen in February, but it was not till the beginning of March that pulling was started in earnest. The cases used are the standard ½-bushel case, holding about 22¼ lb. of tomatoes, and were supplied by the factory. A good puller can pull and pack fifty to sixty cases a day in a good crop, and as 100 cases go to the ton it costs 10s. per ton to pull with wages at 5s. per day.

Being a large bed things were very busy for a few weeks. On some days as much as 3 tons of fruit was put on the trucks. Pulling continued till 18th April, when an early frost brought things to a finish. The bed yielded an average of 5 tons to the acre, which is a good return. With tomatoes at £3 10s. a ton this shows a gross return of £17 10s. Against this is the pulling, which ran into £2 10s. per acre; carting, 5s. a ton (25s. per acre); transplanting, 15s. per acre; ½ oz. seed, 1s. 3d. This leaves a net return of

£12 18s. 9d. to cover rent, ploughing, and general cultivation. This would reduce the actual profit to about £10 per acre, which is a good return. There are few other crops grown under similar conditions, which can show a return equal to the above. There is little encouragement, however, for a man to embark in this industry just at present. Under ordinary circumstances the factories get sufficient from their clients without any outside stuff at all, so that the man who has a few acres of tomatoes on his hands very often has difficulty in disposing of them. During the past season it was a common thing to read in the market quotations: Tomatoes, choice 1s. 6d. to 1s. 9d.; good, 1s; small, 6d. per case. It must be admitted that even the highest price here quoted leaves little margin for the producer after all expenses are paid, whereas the lower prices really leave him in debt, as the agent's commission alone runs from 6d. to 7d. The man who makes a speciality of early tomatoes for supplying shops and greengrocers generally meets with a good market. The seed is sown in a hot bed in June or July, transplanted into pots when large enough, and when frosts are over moved into the open ground. The extra labour which this method entails is well repaid by the splendid returns which the very early tomato crop usually gives.

Insects which attack Vine Buds.

Mr. W. Wesley, of Port Macquarie, has brought under notice specimens of a beetle which is becoming a very serious vine pest in his district. The Assistant Entomologist, Mr. Gurney, identifies the insect as an Elephant Beetle (*Orthorrhinus glindrirostris*), which is generally regarded as a pest of citrus trees.

Mr. Wesley points out that he first noticed the beetles about four years ago. They attack the vine buds both before and after they have burst; and, as the season advances, the insects increase in numbers, eating the bark from the young wood and destroying the young grapes.

The Assistant Entomologist advises that the simplest remedy is hand-picking, or jarring the vines over a sheet or strip of canvas, moved along under one or two vines at a time. The stakes and the butts of the vines need to be closely examined when hand-picking. If the vines can be thoroughly examined periodically, a decrease in the pest will soon be apparent. Where hand-picking would be out of the question, spraying with

2 lb. Swift's arsenate lead
50 gallons water

is recommended to poison bark and foliage thoroughly, without injuring the tender growth. There is a smaller species of the same genus as this beetle, which bores, in the grub stage, in vine canes. In cases where traces of the damage caused by this beetle can be found, pruning and burning infested canes is the readiest remedy.

The apple and vine-root borer (*Leptops Hopei*), a similar weevil, attacked the vine and apple buds in the Maitland district, and was checked chiefly by hand-picking, as above.

Thousand-headed Kale.

W. H. WEBB, Hathrop, Bathurst.

FOR about nine years I had a fancy for Thousand-headed Kale, but hesitated, fearing that it would not stand dry weather, and I did not relish the idea of transplanting and keeping the weeds down until it got a good start. After seeing favourable accounts of it from Tasmania, and having read many times Mr. G. Valder's experience of it, as published in *The Farmers and Fruit-growers' Guide* of 1897, I at length determined to try it on about 2 acres of

Thousand-headed Kale at Hathrop, Bathurst.

rich alluvial land on May 29, 1908. On account of the dry autumn (March 21 points, April 69, and May 110 points) the land did not come to a nice tilth all over. It was harrowed and rolled. Ten pounds of seed were put on the surface with a drill, every second hole being blocked to get the rows about 18 inches apart. Two hundredweight of No. 3 manure to the acre was dropped on the surface at the same time, and then followed the harrows to cover the seed.

We had 81 points of rain during June, the heaviest fall being 28 points; July 94½ points, heaviest 28; August 118, in six falls; September 154, in eight falls; October 50 points, in four falls. The frosts were very severe, that on July 25 registering 10 degrees, being 22 degrees of frost on the grass.

On October 9 the land between the rows was worked with a horse-hoe.

From the 5th to the 9th October, 8,000 plants were removed by thinning out the rows, and put in on higher ground (covering about 1 acre, being in rows $2\frac{1}{2}$ feet apart each way) from which the water runs away smartly and where crops had failed for three years. During the transplanting on the 5th and 6th October the days were fearfully hot and dry—hence plants were watered the next day—but the 7th, 8th, and 9th were cool and cloudy.

During November seven falls of rain gave $140\frac{1}{2}$ points, and in December four falls gave 122 points. Notwithstanding the dry winter, fearfully dry spring—which was said by many to be the worst ever known here—and the hot winds, by the 13th November the kale on the 2-acre flat was flourishing, much being 8 to 12 inches high and all strong and healthy. The lot that was transplanted to the higher ground also grew well, and the plants were from 8 to 12 inches high on 13th November. On the 19th November about forty persons, including many farmers, came by invitation to see the crops. They were surprised to see the healthy state of the kale, and thought it had been irrigated or at least watered; neither had been done, except as stated above. The grass around the district was dead and dry, even the lucerne was curled up and dying off, yet the kale was green.

The Bathurst *Daily Argus* of the 21st November last, referring to the inspection, said:—

Astonishment was expressed by all who saw the crop, and one result of the visit will undoubtedly be many trial experiments of a similar character in the future.

The dry weather of December, with only four wet days, and hot winds; and the climax came on January 3, when the thermometer registered 105, and at 5·15 p.m. a fearful dust-storm which was followed by another at 6·45 p.m., both of which made darkness come over the paddocks so that one could not see 5 yards. January 4 the heat was 106, and yet another fearful dust-storm on the 13th at 5·30 p.m. Lucerne and grass all dead or dying, and the kale beginning to look sick, and being attacked by aphis it was treated with arsenate of lead.

On January 18 a lovely rain, giving 125 points, followed with 10, 38, and 111 points in three successive days, set things right. The recovery of the grasses was slow, and the kale was the first to be ready for stock, beating even lucerne, many leaves running to 11 x 8 inches by February.

On February 12, 1909, thirty-two rams were put on the 2-acre plot and kept there until April 10, by which time they ate the kale at the gate end too short, so that most of it died. They should have been hurdled in sections on the kale.

On February 20, one hundred ewes were put on the acre plot and kept there about 1 hour daily until March 5. This, and one feed of chaff daily, kept them improving in condition. On March 8, thirty-nine ewes were put on the acre plot and left there until April 10, when the kale was stripped, leaving the stalks only.

During the winter the stalks sent out leaves just like Brussels sprouts, and forty-nine ewes have been on the 2-acre plot for some time. The acre plot has been kept for some special sheep, and on the 18th July, 1909, a few of

the plants were measured around the top parts and gave 53, 54, 76, 55, and 72 inches. They all have fair heads on this plot. These will be eaten off and then allowed to run out strongly, so as to supply green food during December and January, when green food safe from hoven is scarce in dry times.

Thousand-headed Kale at Hathrop, Bathurst, looking across the rows.

If sowing again I would select the spring. In Tasmania, some gentlemen told me, they grow Thousand-headed Kale to weigh 70 lb. each. Some I put in the garden last spring weighed 26 lb. in July. I consider the test the above kale had was a very severe one as the season was very bad. Many farmers had no crops, while others cut 200 acres for 20 tons, and so on.

Fertilisers in South Australia.

The fertiliser season has just closed, and the Chief Inspector estimates that during the twelve months ended June, the quantity used by producers was 80,000 tons, of which it is believed 76,500 tons was committed to the soil to assist cereal crops, which will be reaped at the end of this year. The balance of 3,500 tons was distributed amongst orchardists and gardens.

The quantity deposited with grain is put down at 80 lb. per acre, which is regarded as a fair average. This indicates that an area of 2,100,000 acres has been manured.

Some idea of the value which farmers attach to the use of fertilisers may be gathered from the figures for the last twelve years, which have grown from 3,000 tons on 60,000 acres in 1897, to 44,500 tons on 1,000,000 acres in 1903; and 76,500 tons on 2,100,000 acres in 1909.

Cowpeas at the Grafton Experiment Farm.

For the purpose of securing a stock of pure seed of varieties of cowpeas for farmers' experiments this season, in January last 1 peck of seed of each of the following varieties was sown at the Grafton Farm:—New Era, Clay-coloured, White (from Department of Agriculture), and Black and Whip-poor-will (local seed). The area set aside for the crops was 4¼ acres, and in the red soil, which comprised the area, the seed was sown in drills 2 feet 6 inches apart.

At the time of planting the weather was extremely dry, but the cowpeas upheld their reputation as drought-resisters, and germinated well and made growth whilst other crops were at a standstill.

Below is a record of the yields, and some conclusions arrived at as a result of the experiment:—

Variety.	Date of Sowing.	Seed per acre.	Area.	Date Harvested.	No. of days to ripen.	Yield of Seed.	Yield per acre.
		lb.	acres.			lb.	bus. lb.
New Era	7 Jan.	8	1¾	1 April.	84	1,246	11 52
Clay-coloured	9 ,,	7½	1¾	29 ,,	110	1,098	10 28
White	11 ,,	8½	¼	28 ,,	107	636	42 24
Black	11 ,,	8	¼	5 May.	114	656	43 44
Whip-poor-will	11 ,,	8	¼	13 ,,	122	312	20 48
	...	...	4¼	...	...	3,948	...

Rainfall during growth was as follows:—

January, 54 points. March, 381 points. May, 15 points.
February, 292 ,, April, 270 ,,

It is necessary to point out that the three varieties, Black, White, and Whip-poor-will were grown under the same soil conditions and had a considerable advantage over the varieties of New Era and Clay-coloured, which were grown on another section of the farm where the tilth was not so perfect; it must be noted also that the New Era seed sown was not first-class, a considerable number did not germinate.

New Era is more of a bush variety, not so "viney" as the others under observation, and is the earliest of the five varieties. It would be suited to the colder or shorter-seasoned districts. Ripening of the pods does not take place at the one time, but extends over twenty days. It is a very useful variety as a catch crop.

White.—This is a medium early variety, and gave a heavy yield of vine and leaves. Would be suitable for hay, fodder, or green manuring. It is a good seed-producer.

Clay-coloured.—This variety embraces very nearly the same qualities as the White, but is not so prolific.

Whip-poor-will.—Is a late variety and makes rather a strong growth of vine. It was noticeable that a large percentage of pods fell off when ripe and a considerable loss of seed ensued. It is also very uneven in ripening its pods, and the seed is harder to thresh out than that of other varieties. It is the least desirable of the varieties tried this season.

Black.—This proved to be the most satisfactory of the varieties under trial, the chief feature being a remarkably even ripening of the pods. This is a very important factor in any variety when it is grown for seed, as it only

requires the one picking, whereas other varieties such as New Era and Whip-poor-will have to be gone over two or three times, as the pods ripen, or when the crop is cut a lot of the immature pods are lost.

For general adaptability the Black Cowpea is unrivalled. It possesses all the desirable characteristics, giving a heavy yield of seed, vine, and leaves, and is adapted for green-manuring, hay or green fodder. As a cover crop in foul land to choke out weeds it would prove useful. The even ripening characteristics render it a safe variety to grow when seed is the object.

Cut-worms and Grass-worms.

Mr. W. B. Gurney, Assistant Entomologist, reports :—

"A look-out for caterpillars (cut-worms and grass-worms) should reveal the first of these about September.

"During August reports having appeared and specimens being obtained, I find the dark somewhat heavy caterpillar of a grass-eating species (*Apina callisto*), Fig. 1, has appeared in swarms in the western districts from Narromine to Nyngan, the Bogan River, and in the south-west at Balranald.

"This grub mainly confines its attacks to grass and herbage, such as 'crowfoot,' but the true cut-worms, the caterpillars of the Bugong Moth (*Agrotis infusa*), Fig. 2, of *Mamestra Ewingii*, Fig. 3, of the Army-worm Moth (*Leucania unipuncta*), Fig. 4, the Maize or Tomato Moth (*Heliothis armigera*), and other noctuid moths attack cereal crops and vegetables. Fig. 5 shows a typical cut-worm.

"The caterpillars appear in late winter and spring, from pupæ (chrysalids) which have wintered in the soil, and sometimes in such numbers as to destroy practically all the grass and crops as they advance. There may be three or four broods in warm districts. The eggs are laid on grass ; from these hatch the caterpillars which spread, feeding and growing, and when full grown burrow an inch or two below the soil and pupate. Adult moth emerge from the pupal stage in about two weeks and again lay eggs on grass or crops.

"When in the crops the most effective method is destroying with poisoned bran or pollard. *Formula :* 1 lb. Paris green, 16 lb. of bran or pollard, or both, mixed dry in quantity ; add water and make a mash which will readily crumble in the hand. A little salt or some molasses added makes this more attractive to the caterpillars. Pellets of this mash should then be spread broadcast in the crop where the cut-worms are, and they feed on it at night and are poisoned in numbers.

"The running of a deep furrow in the front of the line of march of the caterpillars temporarily checks their advance ; they enter the furrow, and if the opposite side has been cut vertically are unable to climb up. Numbers are thus collected and may be destroyed with oil-spray or by a log-crusher drawn along the furrow.

"Where the caterpillars are crawling on hard ground or short grass, they may be destroyed in numbers by bundles of brush, weighted, and drawn to and fro. A flock of sheep driven close is similarly effective. If noticed in dense patches, a contact spray is recommended of blue oil, red oil, or kerosene emulsion (1 gallon oil, 6 gallons water, 1 lb. soap), well emulsified. Spray directly on to the caterpillars. Where there is no danger from the presence of stock, poisoning the grass or a strip of the crop about the caterpillars is effective. Formulæ: 1 lb. of Paris green or white arsenic to 100 or 150 gallons of water ; or 2 lb. of arsenate of lead to 50 gallons of water."

Grass Pest (*Apina callisto*).
No. 1.

A Cutworm Moth (*Mamestra Ewingii*).
No. 3.

The Army Worm Moth (*Leucania unipuncta*).

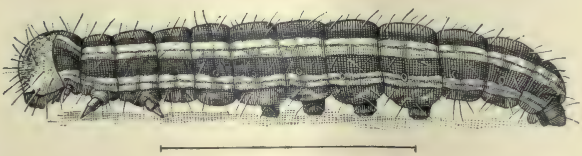
The caterpillar stage of this moth is one of the worst pests of crops and grass.

No. 4.

Bugong Moth (*Agrotis infrisa*)

The caterpillar stage of this is a very destructive cutworm.

No. 2.



Cutworm.

No. 5.

CUTWORMS AND GRASSWORMS.

The Potato Blight.

Dr. F. TIDSWELL (Director) and Mr. T. HARVEY JOHNSTON (Assistant Microbiologist), Bureau of Microbiology.

In May last the pronouncement of Mr. Henry Tryon, of the Queensland Department of Agriculture, that "Irish Blight" existed in both Tasmanian and Queensland potatoes, led to a more than usually close scrutiny being made of potatoes arriving here from the States mentioned. On 3rd June the services of the Bureau were requisitioned with respect to a parcel of potatoes from Tasmania for opinion as to the nature of the disease with which they were obviously affected. The microscopical and cultural examinations then made revealed the presence of the fungus *Fusarium solani*, causing dry rot, and several bacteria, amongst which was *Bacillus solanacearum*, which is regarded as a cause of wet rot in potatoes; but the fungus of "Irish Blight," *Phytophthora infestans*, could not be found. It is well known, however, that the fusarian and bacillary rots are often associated with "Irish Blight," and that quite commonly they obscure the presence of the latter, and render it difficult of detection. A warning to that effect was given and acted on, and the search was continued through further samples of Tasmanian potatoes, until in one submitted on 5th August *Phytophthora* was detected, and subsequently induced to develop its characteristic fructification and spores. As Mr. D. McAlpine, the Victorian Vegetable Pathologist, has also affirmed that Tasmanian potatoes are affected with "Irish Blight," the matter can now be scarcely regarded otherwise than as an established fact.

Descriptions of the "wet" and "dry" rots, as well as "Irish Blight," were reproduced by Mr. Butler in his article on "The Potato" in the last issue of the *Agricultural Gazette* (August 2, 1909, p. 696), so that in this place it will be necessary only to add such other points as have come within our personal experience. The potatoes with which we had to deal have usually been affected with more than one of the conditions previously mentioned, and we have not found ourselves able to distinguish one from the other by the naked eye. Nevertheless, there is no possibility of confusion between them when examined under the microscope, more particularly if the fungoid parasites have been cultivated, and so encouraged to produce their spore-bearing organs. Speaking generally, our experience has been that when the cultivated potatoes are affected with both "dry" and "wet rot," the predominating growth varied according as the conditions were dry or moist. If kept fairly dry, the *Fusarium* was found to gain the upper hand, and the tubers finally shrivelled into a hard dry mass, covered with a dense, rather short, white or pinkish mould-like growth, consisting of fungus filaments (hyphae), and bearing myriads of tiny, sickle-shaped, septate spores readily discernible under the low power of the microscope. Under moist conditions, bacterial growth was much more in evidence, and caused the rapid putrefaction of the potato, the material of which became soft, slimy, dirty brown or black, and very foul. As already mentioned, either of these

conditions could readily overwhelm any *Phytophthora* that might have been present, and perhaps did so several times before we secured specimens in which the Blight became pronounced. Tubers which appeared to us favourable for this purpose, showed in areas a rather loosely attached crumpled skin, a little sunken and dark coloured, which was very easily stripped; and immediately underneath this skin, a brownish area, dipping more or less into the potato, which is at this region usually softened and often of a faint bluish colour, but it is not thought that this appearance is characteristic of Blight. Material from the affected area examined under the microscope shows the peculiar hyphae of *Phytophthora*, and, if developed, the characteristic fructification and lemon-shaped spores. These also can be readily seen with a low power of the microscope. Whilst it would serve no useful purpose to give in this place further details of the structure of this fungus, it may be noted, as a matter of importance, that its hyphae penetrate in between the cells of the potato tuber, and live there ready to develop when opportunity occurs. The fungus is said to be a true parasite, and to feed upon the living tissue. However this may be, it appears to be able to remain dormant in potatoes for a time sufficiently long to enable *infected tubers to be accepted and planted as healthy seed.* This seems to have been the way in which the disease has been spread from place to place. On the other hand, when the disease attacks the foliage of the plant above ground its spores are thrust out from the small respiratory openings or stomata on the under side of the leaves, and then may be distributed about the field by wind currents. Under moist conditions the spores can then germinate wherever they are deposited on other plants, and so give rise to fresh infections. Given suitable opportunity for development the issue is devastation.

At the present time it is impossible to say how long blight has been existent in Tasmania; apparently local growers had no suspicion of its presence, so that it is either of recent introduction, or has been present under circumstances in which it does not exert the baneful effects recorded in Ireland and in New Zealand. The latter idea, while quite hypothetical, is certainly not an impossibility—Blight and climatic conditions seem to have been closely related. It may be that even if introduced into this State, it may not succeed in getting an epiphytic footing. There is some comfort in this hope, since this State has, no doubt, been exposed to the risk of its entry. In this disease, as in all others, there must be a stage when it is not recognisable to our unaided senses—one in which infected potatoes could not have been noticed by the inspectors, and in that stage it may have been introduced before its existence was discovered or even suspected in Tasmania or Queensland. The extra precautions which have been taken since its discovery in May last afford a further measure of protection to this State. As already mentioned, the first samples of potatoes submitted were found to be affected with *Fusarium* and bacilliary rots; these, being serious in themselves, were proclaimed under the "Vine and Vegetation Diseases Act, 1901," on June 16 last, and thenceforth excluded from importation. No doubt this has helped to exclude also *Phytophthora*-infected specimens. Nevertheless, it is very

important that growers, not only in the State's interests but also in their own, should keep a close watch upon crops raised from Tasmanian stocks, and immediately call the attention of the Department to any mal-condition thereof. Treatment in the earliest stages alone offers much likelihood of success. The measures to be adopted have already been dealt with in Mr. Butler's article. We have only to add to them a suggestion with regard to potato bags, which will be rendered perfectly safe if they are boiled (truly boiled) for at least ten minutes in water.

Second-hand Potato Bags.

The farmers of Crookwell district have already moved in the matter. Headed by Messrs. McCourt, James, Thomas, Lonsdale, Trefle, and Jones, M's.L.A., Messrs. Gay, Beasley, and MacInnes, representing the potato-growers of Crookwell district, waited upon Hon. J. Perry, Minister of Agriculture, on August 3, 1909. The deputation pointed out that the farmers feared that any or all of the diseases now prevalent in Tasmanian potatoes might be introduced into New South Wales and widely disseminated through the bags, and it was stated in support of this contention that the introduction of codling moth and other diseases to this State could be traced to distribution in fruit-growing districts of the cases or packages in which the fruit had been brought here. It was added that the Crookwell district relied largely on potatoes for its prosperity, the farmers having adopted potato-growing when the fruit pests became too bad for them to cope with. They suggested that a brand be put on every Tasmanian bag which comes into Sydney.

The Minister of Agriculture, in reply, said he was in sympathy with the deputation. When the Irish Blight was reported in New Zealand some time ago, a proclamation was issued prohibiting the importation of potatoes from the Dominion. The utmost vigilance is at all times exercised by the Inspectors of the Department at Sydney, and during the past two months the Inspectors had condemned a large quantity of potatoes infected with dry rot, which the Director of the Bureau of Microbiology identified as a contagious disease of potatoes. The Director of the Bureau of Microbiology, and the inspectors on the wharves, are in constant touch, so that there is extremely little likelihood of any diseased produce escaping detection. At the same time, however, Mr. Perry said, he would be glad to see adopted a system of inspection at the port of export as well as at the port of entry, as thereby even greater security would be ensured.

As to the question of second-hand bags, the Minister would strongly urge on the growers that the best way to prevent disease being brought to their district through second-hand bags was *not* to buy them. nor allow their agents to send them on any pretext or for any purpose. It would be impossible to keep track of every bag introduced from abroad, and to either destroy or disinfect it. It it were found absolutely necessary to use second-hand bags, no risks should be run; and they ought to demand some

guarantee that their agents have had such bags disinfected by boiling or steaming at a sufficient temperature before despatch to their farms.

Luckily the note of warning has been sounded just at the commencement of the planting season, when every grower is in a position to ask himself whether he is absolutely sure of the healthiness of the tubers he is about to utilise for seed. If there is the slightest doubt about this point, the potatoes should be very carefully hand-picked and overhauled, and any obviously-diseased ones destroyed by boiling in an old kerosene tin or something of the kind, or burned. Do not throw them on the ground to create further trouble.

If seed potatoes have to be purchased, be sure to get them from reliable merchants who have obtained seed from healthy districts, and have hand-picked it and taken every precaution to exclude any doubtful tubers.

There is a market for second-hand potato bags for coke, breeze, lime, and other articles, so that if any grower has a big stock on hand, their rejection for use in the potato crop need not be dead loss.

As readers are aware, the importation of potatoes from Tasmania was prohibited under Proclamation dated 13th August, 1909.

FOLLOWING on the discovery of Potato Blight in Tasmania, this dreaded disease has been found in full fructification on an apparently-sound tuber grown in the Kyogle District, Richmond River.

The crop from which this affected potato was obtained was grown from seed imported from Tasmania by a Sydney seed firm, and planted at Kyogle in July of last year. The grower reports that a number of sets rotted at an early stage, but nothing in particular was noticeable in respect to the tubers which matured. Some of these were used for seed in February last in the same area, and the resultant **potatoes, although presenting a perfectly normal appearance externally, on being cut disclosed a not very conspicuous fringe of discoloration in the flesh.** The ordinary user of potatoes for cooking and for seed would scarcely notice anything seriously wrong with such tubers, but the moment minute inspection is made through the microscope all the **absolutely unmistakable symptoms of Irish Blight are revealed.**

Fortunately the district in which the Blight has been found is one from which few, if any, potatoes are distributed to other portions of the State. The patches under this crop are very small, and practically in every case the whole produce is utilised for home consumption. Nevertheless, no precautions will be neglected by the Department of

Agriculture, and the co-operation of every grower in the State is earnestly asked in the measures to be taken with the **object of preventing the spread of the Blight.** An officer of the Department is now in the Kyogle District to visit every holding and to see that every doubtful tuber is destroyed by boiling or by fire. The fact that the Blight-infected potatoes at Kyogle presented no conspicuously visible signs of disease simply shows how necessary it will be for potato-growers in all districts to **leave nothing to chance, but to most carefully hand-pick all tubers intended for seed, and after rejecting any doubtful ones and completely destroying them by fire or boiling, to dip the rest in a solution of eight ounces (or half a pint) of commercial formalin to fifteen gallons of water for two hours.** This quantity will be sufficient to treat 10 cwt. of tubers. Commercial formalin may be obtained in country districts at about 2s. per pound bottle, or 14s. per gallon; so that, roughly speaking, the seed potatoes can be treated for 2s. per ton. Before placing the tubers in the formalin solution they should be very carefully washed in water so as to remove all particles of soil, &c., and the **water** in which such tubers have been washed should afterwards **be boiled to avoid risk of scattering any of the germs on the soil** or over clean potatoes. For the solution any kind of vessel may be used, as it does not corrode metal. **Formalin is poisonous, and, therefore, ordinary precautions should be observed in its use.** It may also be likely to somewhat retard the development of the eyes; but if used with due care, and not longer than the time indicated, no bad results need be anticipated. Very small, thinly-cut sets might be affected by the formalin. Growers cannot be too emphatically advised to avoid the use of second-hand potato bags. If any containing seed have recently been brought to the farm, the potatoes should be carefully removed, and the **bags and particles of rubbish in each should be boiled for at least half an hour.** Care should also be exercised as to the disposal of the potato peelings and rejected portions of tubers from the kitchen.

The infected districts have been duly quarantined.

Farmers' Calendar.

The aim of the Department of Agriculture in issuing this calendar is to provide farmers, and more especially newcomers in respective districts, with guidance as to seasonable operations.

The experience of every successful agriculturist goes to prove that no matter what the climatic and general conditions of a district may be, it is only by timely and thorough preparation of the soil that satisfactory results can be achieved. To provide in any handy form specific details applicable to every district is manifestly impossible. . The best that can be done, at this stage at any rate, is to indicate in a general way what practices have proved successful over a prolonged series of seasons in certain distinct localities. By comparison of the altitude, average annual and monthly rainfall, and other conditions of their own district with those for which specific details are now given, it is thought agriculturists will be able to strike the happy medium.

Each officer of the Department who has contributed matter for this Calendar has set forth a list of the districts of which he is of opinion the conditions of his farm are typical. But in a country of such widely different conditions as those of this State, it is quite possible that quite a large number of districts are entirely unrepresented. In such cases growers are requested to communicate with the Department in order that reliable advice for their guidance may be obtained and published.

A seeding table for each district is in preparation.

Contributors to the Calendar are :—

North Coast—Richmond-Tweed Section.

H. R. ALEXANDER, Manager, Wollongbar Experiment Farm.

Directions for the Richmond-Tweed section apply to practically all the districts embraced by the Big Scrub and as far as Lismore and a little beyond Murwillumbah. With slight modifications, the particulars will also apply in the case of main crops for dairy fodder, to the districts surrounding Casino and Kyogle.

North Coast—Clarence-Macleay Section.

A. H. HAYWOOD, Manager, Grafton Experiment Farm.

Directions for the Clarence-Macleay section apply to practically all districts between these two rivers with the exception of Don Dorrigo and other elevated plateaus, which, on account of cold nights, are more akin to the Tablelands in respect to cultural matters.

Hawkesbury-Nepean.

H. W. POTTS, Principal, Hawkesbury Agricultural College.

Directions for the Hawkesbury-Nepean district apply to Camden, Campbelltown, Liverpool, Penrith, Picton, Richmond, Sackville, St. Marys, Windsor, Wiseman's Ferry.

South Coast.

P. QUIRK, Manager, State Stud Farm, Berry.

MR. QUIRK'S directions apply to Araluen, Bateman's Bay, Bega, Berry, Bodalla, Bulli, Candelo, Cobargo, Colombo, Eden, Gerringong, Kiama, Merimbula, Milton, Moruya, Nelligen, Nowra, Pambula, Picton, Shellharbour, Ulladulla, Wollongong, Wolumla.

Tablelands—Northern.

R. H. GENNYS, Manager, Glen Innes Experiment Farm.

DIRECTIONS for Northern Tableland apply to districts adjacent to the Great Northern Railway from Armidale to Tenterfield, and to such elevated districts further south as Uralla and Walcha. Tenterfield is an earlier district than Glen Innes, but the directions generally apply, and also in the case of Inverell to a large degree.

Tablelands—Bathurst Section.

R. W. PEACOCK, Bathurst Experiment Farm.

MR. PEACOCK'S directions, with slight modifications, are applicable to Bathurst, Blayney, Braidwood, Goulburn, Queanbeyan, Yass, and other fairly elevated districts adjoining.

Central-Western Slope.

GEO. L. SUTTON, Wheat Experimentalist and Manager, Cowra Experiment Farm.

MR. SUTTON'S directions, with slight modifications to meet differences in altitude and other natural conditions, apply to the following districts:—Canowindra, Cargo, Cowra, Dubbo, Eugowra, Forbes, Grenfell, Molong, Murrumburrah, Parkes, Temora, Wellington, Young.

The reminders would also apply, in a very large degree, to the slightly earlier districts of Condobolin, Narromine, and Trangie.

Riverina.

G. M. McKEOWN, Manager, Wagga Experiment Farm.

DIRECTIONS for Riverina apply to the majority of districts along the southern line and branches from Junee to Albury, Junee to Jerilderie and Deniliquin; also Corowa and Berrigan.

North-Western Plains.

A. E. DARVALL, Manager, Moree Experiment Farm.

DIRECTIONS for the North-western Plains apply more especially to the black-soil plains of the north-west, where irrigation by means of artesian bore water is practised.

Since compiling the table the following districts have been added:—

Cowra, 978 feet above sea-level, with an annual rainfall for 23 years of 24·99 inches.

Kempsey, only about 25 feet above sea-level, with an annual rainfall for 25 years of 64·62 inches.

Moree, 686 feet above sea-level, with an annual rainfall of 23·22 inches over a period of 28 years.

Rainfall and Temperature Table.

Particulars furnished by Mr. H. A. Hunt, Commonwealth Meteorologist.

District.	Altitude above sea level (ft.).	Average annual rainfall.	Number of years' records.	Average monthly rainfall. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Extreme temperatures. Max.	Min.	Frosts. Earliest recorded.	Latest recorded.
Albury	534	28·15	40	1·48	1·70	2·10	2·29	2·57	3·47	2·73	2·87	2·60	2·90	1·95	1·61	117·3	20·2	5 April	27 October.
Armidale	3265	31·79	42	3·66	3·37	2·94	2·03	1·85	2·68	2·01	1·99	2·28	2·83	3·30	3·67	105·2	13·9	5 February	21 December.
Barmedman	788	18·61	27	1·52	1·24	1·56	1·78	1·44	2·04	1·57	1·44	1·71	1·89	1·16	1·29	114·3	15·5	27 April	26 September.
Bathurst	2155	23·88	50	2·46	2·18	2·06	1·77	1·83	1·92	1·63	1·67	1·87	2·16	2·13	1·92	112·5	13·0	4 ,,	13 November.
Bega	50	31·81	25	2·90	3·10	3·53	2·66	2·96	3·34	2·12	2·58	2·07	2·81	2·10	2·73	115·6	16·6	15 ,,	12 October.
Berrigan	390	16·65	13	9·7	8·2	1·31	1·21	1·44	2·11	1·24	1·79	1·25	2·17	9·6	1·38	....	....	Not reported	Not reported.
Berry	24	56·54	22	6·30	5·32	7·01	6·04	4·60	6·71	5·33	4·13	3·52	3·42	3·60	4·64	109·8	27·2	30 April	1 November.
Blayney	2844	30·09	22	3·22	1·76	2·44	2·26	2·02	3·18	2·52	2·69	2·43	2·42	1·76	2·55	....	....	1 February	27 December.
Bodalla	40	36·55	32	3·43	4·12	4·26	2·90	2·92	3·06	2·27	2·52	3·02	2·99	2·69	2·73	114·1	18·6	18 April	18 October.
Bourke	350	15·27	35	1·95	1·91	1·57	1·37	1·08	1·07	·86	·86	·93	1·09	1·30	1·15	127·0	25·3	23 May	2 September.
Bowral	2210	37·75	23	3·60	2·97	4·78	3·19	2·80	3·98	3·88	2·94	2·16	2·58	2·50	3·02	105·0	20·0	17 March	18 October.
Braidwood	3157	24·45	31	2·73	2·58	2·31	2·36	2·25	2·58	1·87	2·16	2·05	2·42	2·05	2·22	104·9	14·3	12 February	4 November.
Brewarrina	392	16·63	35	2·13	1·85	1·92	1·37	1·13	1·60	·96	·96	1·48	1·12	1·20	·86	122·3	24·8	18 ,,	8 August.
Bundarra	2000	29·57	23	3·65	2·11	2·81	2·15	1·78	2·08	1·69	2·04	2·40	2·61	2·52	3·62	101·0	17·5	10 ,,	2 November.
Carcoar	2363	29·78	26	2·72	1·69	2·10	2·16	2·10	3·84	2·60	2·73	2·69	2·89	2·27	2·13	104·9	15·4	2 January	16 ,,
Casino	77	43·81	32	5·48	6·24	6·14	4·20	3·04	2·45	2·64	2·20	2·19	2·92	3·34	3·93	116·4	21·0	24 May	21 September.
Cassilis	1500	23·96	36	2·48	2·54	2·28	1·40	1·86	1·94	1·57	1·87	1·91	1·81	1·99	2·27	111·7	15·8	10 March	30 November.
Collarenebri	477	18·71	23	2·01	2·21	1·87	1·07	1·60	1·48	1·10	1·16	1·29	1·35	1·65	1·67	121·0	21·0	8 June	18 August.
Condobolin	653	17·68	25	1·76	1·35	1·60	1·63	1·56	1·50	1·26	1·51	1·29	1·61	1·13	1·49	122·2	20·5	19 May	9 September.
Coolamon	823	20·71	20	1·51	1·29	1·89	1·81	1·71	2·37	1·98	1·78	1·62	1·97	1·29	1·08	118·5	25·0	25 April	2 October.
Cooma	2662	19·18	42	2·00	2·30	1·81	1·34	1·13	1·44	·95	·92	1·59	1·85	1·96	1·61	112·0	8·5	6 January	24 December.
Coonamble	589	19·92	28	1·82	2·22	2·11	1·85	1·66	1·46	1·22	1·37	1·55	1·61	1·48	1·48	117·9	21·9	— April	21 August.
Cootamundra	1082	23·14	19	2·59	1·36	1·85	2·03	1·68	2·61	2·08	1·97	1·84	2·34	1·43	1·82	112·0	19·9	25 February	24 October.
Corowa	503	19·56	25	1·49	1·21	1·79	1·61	1·87	2·59	1·89	2·03	1·86	1·94	1·46	1·48	114·0	26·0	4 April	30 September.
Crookwell	910	31·86	24	3·09	1·71	2·36	2·30	2·00	3·92	2·92	3·15	2·96	2·74	2·44	2·52	100·8	12·1	16 January	15 December.
Deniliquin	268	16·46	47	1·03	1·08	1·51	1·59	1·61	1·73	1·25	1·40	1·63	1·60	1·17	·85	121·1	18·0	23 March	28 September.
Dubbo	867	22·46	35	1·91	1·80	1·86	1·97	1·95	1·95	1·55	1·78	1·89	1·78	1·83	2·03	115·4	19·9	14 ,,	13 October.
Eden	107	34·34	38	3·15	3·31	3·17	2·98	3·75	3·58	2·46	2·25	2·56	3·03	2·58	2·51	106·0	29·3	Not reported	Not reported
Forbes	783	20·16	32	1·61	1·67	2·16	1·84	1·85	1·73	1·51	1·72	2·25	2·00	1·33	1·57	118·4	24·0	6 May	3 October.
Germanton	957	27·43	23	1·95	1·33	2·07	2·21	2·36	3·86	2·93	2·67	2·28	2·83	1·94	1·83	108·0	20·0	1 April	29 ,,
Gilgandra	942	25·14	24	2·46	1·88	2·26	2·54	2·12	2·03	1·95	1·99	1·67	1·84	1·81	2·44	118·1	20·0	16 ,,	4 ,,
Glen Innes	3520	32·09	26	4·62	2·90	2·82	1·83	1·97	2·42	1·77	1·90	2·32	3·24	3·26	3·73	107·3	14·4	5 April	3 October.
Goulburn	2074	25·63	50	2·78	2·52	2·14	1·78	1·98	2·04	1·59	1·85	2·15	2·51	2·27	2·33	111·0	13·0	21 March	25 ,,
Grafton	29	38·77	35	5·15	4·85	4·78	3·69	2·63	2·51	2·25	1·76	1·92	2·61	2·92	3·55	118·0	20·09	23 April	17 September.
Grenfell	1238	25·04	22	2·17	1·88	2·19	2·09	1·95	2·76	2·21	2·15	2·27	2·24	1·42	2·01	106·0	29·0	24 ,,	14 October.
Gunnedah	876	24·72	28	2·29	2·46	2·64	1·75	1·89	1·69	1·49	2·17	1·90	2·13	1·99	2·48	120·6	16·7	25 May	12 September.
Gulgong	1476	26·45	26	2·52	2·16	2·51	2·25	2·05	2·42	1·77	2·02	2·03	2·25	2·04	2·53	109·0	26·9	20 April	14 ,,
Hay	307	14·35	27	·86	·96	1·22	1·38	1·44	1·71	1·18	1·46	1·24	1·22	·84	1·03	117·3	21·1	9 May	22 ,,

Inverell	1912	30·73	30	3·70	2·79	3·05	2·10	1·98	2·23	2·01	1·97	2·26	2·68	2·42	3·00	110·6	13·4	11 March	2 November.
Jerilderie	368	15·64	20	·99	·88	1·33	1·48	1·62	1·87	1·23	1·78	1·16	1·41	1·33	1·03	....	....	23 May	8 September.
Jerry's Plains	150	23·14	22	2·08	2·06	2·75	1·60	1·41	1·92	2·06	1·45	1·52	1·77	1·97	2·35	121·17	24·0	21 May	7 October.
Junee	988	28·80	24	1·58	1·22	1·84	1·67	1·70	2·34	1·78	1·84	1·91	2·06	1·44	1·40	111·9	26·9	12 April .. .	21 ,,
Kiandra	4640	64·70	33	4·11	3·15	4·20	4·56	5·34	8·81	6·34	5·99	6·75	6·92	5·06	3·69	102·3	–20·0*	6 January ..	25 December.
Kurrajong Heights ..	1870	49·98	40	5·58	6·07	6·38	4·51	4·43	3·35	2·90	2·63	2·95	3·02	4·04	4·38	....	....	....	....
Lismore	37	53·52	23	6·32	7·43	7·79	4·72	4·84	3·44	4·28	2·84	2·92	2·75	3·55	4·52	116·2	28·2	8 May	13 August.
Maitland	19	33·57	40	3·29	3·23	3·95	2·82	2·57	2·52	2·75	2·51	2·66	2·38	2·41	2·71	115·0	24·0	10 ,, ...	28 September.
Manilla	1287	26·50	24	2·92	2·39	2·59	2·27	1·87	1·75	1·49	1·48	1·99	2·22	2·60	2·52	....	....	24 April	11 October.
Molong	1736	29·30	23	2·70	1·75	2·76	2·40	2·49	2·84	2·18	2·54	2·44	2·51	1·87	2·95	111·7	18·0	1 ,, ...	6 November.
Moruya Heads	50	35·91	31	3·21	3·43	4·28	3·25	2·94	3·17	2·45	2·39	2·98	3·05	2·38	2·47	114·8	22·3	20 June	6 September.
Moss Vale	2208	39·10	35	3·53	3·61	3·94	3·51	3·75	3·83	3·78	2·66	2·40	3·28	2·77	2·52	106·0	18·9	19 January ..	18 ,,
Mudgee	1536	26·11	34	2·23	2·21	2·00	2·10	2·22	2·49	1·84	2·07	2·34	2·36	1·98	2·43	114·4	15·2	22 March	5 November.
Murrumburrah	1271	23·15	23	2·51	1·32	2·22	2·20	1·70	2·65	2·18	2·21	2·07	2·04	1·52	1·91	114·9	20·0	25 February ..	30 October.
Murrurundi	1548	31·75	34	2·75	2·91	2·60	2·21	2·19	3·00	2·35	2·65	2·46	2·82	2·55	3·20	107·3	19·0	30 March	5 ,,
Muswellbrook	477	23·45	33	2·19	2·37	2·13	1·65	1·67	2·06	1·79	1·75	1·65	1·83	1·77	2·30	117·6	19·0	21 April	21 ,,
Narandera	576	17·18	28	1·53	1·17	1·57	1·61	1·55	2·00	1·58	1·64	1·38	1·79	1·24	·92	114·5	21·5	25 ,, ...	24 September.
Narrabri	697	26·12	36	2·83	2·97	2·56	1·84	2·21	2·09	1·77	1·74	1·83	1·92	2·25	1·99	118·9	18·4	24 ,, ...	17 October.
Narromine	786	18·56	15	1·64	1·18	1·79	1·60	1·60	16 9	1·83	1·71	1·46	1·48	1·28	1·27	....	....	24 ,, ...	26 September.
Orange	2846	36·51	36	2·75	2·75	2·79	2·41	3·28	4·41	3·13	3·36	3·27	3·31	2·79	2·60	....	....	10 January ..	16 December.
Parkes	1035	21·75	18	2·27	1·27	2·45	1·84	2·04	2·13	1·79	1·78	1·98	1·84	1'12	1·32	114·9	20·0	28 April	2 October.
Parramatta	50	36·25	41	3·41	3·84	3·81	3·91	2·96	3·28	3·21	2·47	2·29	2·35	2·37	2·71	....	....	3 May	30 September.
Penrith	89	26·63	11	1·92	13·†	..	..	..	..	..	..	..	..	..	..	....	....	....	....
Picton	552	29·55	28	3·22	2·34	3·52	3·02	2·07	2·47	2·34	1·91	1·93	2·38	2·00	2·71	112·0	19·7	15 April	18 October.
Pilliga	773	20·09	25	2·18	2·19	1·75	1·52	2·06	1·62	1·46	1·52	1·38	1·54	1·39	1·53	116·9	23·9	11 May	24 September.
Port Macquarie	49	62·04	45	6·03	7·40	6 25	6·20	5·99	4·83	4·53	3·91	4·29	3·43	4·10	6·33	105·4	24·8	12 June	1 August.
Queanbeyan	1901	22·75	37	2·39	1·81	2·01	1·71	1·78	1·92	1·34	1·54	1·84	2·43	2·24	2·12	109·4	15·8	18 January ..	25 December.
Quirindi	1279	27·76	24	2·79	2·46	2·60	1·89	2·09	2·19	1·65	2·05	2·10	2·28	2·31	3·00	113·6	17·0	10 February ..	16 October.
Richmond H. A. College..	70	30·18	28	3·42	2·65	3·78	2·55	2·72	2·61	2·33	1·89	2·10	2·20	2·33	2·89	113·5	18·8	15 April	1 November.
Scone	680	23·49	28	2·53	2·65	2·08	1·54	1·55	1·60	1·69	1·90	1·77	1·87	1·80	2·35	114·4	22·2	22 April	24 October.
Singleton	137	29·65	25	2·63	2·83	3·40	2·41	1·88	2·32	2·36	2·08	2·08	2·35	2·50	2·60	113·9	22·0	5 May	15 September.
Tamworth	1279	27·65	27	27·0	2·49	2·06	2·05	1·96	2·20	1·78	2·05	2·17	2·41	2·63	2·64	120·5	20·9	24 April	18 October.
Taree	30	45·24	24	4·16	6·37	4·64	4·26	3·07	3·36	3·55	3·30	3·12	2·66	3·08	4·69	109·9	30·0	24 ,, ...	26 September.
Temora	958	19·34	28	1·64	1·03	1·53	1·57	1·50	2·12	1·66	1·69	1·63	2·10	1·67	1·56	....	....	Not reported ..	Not reported.
Tenterfield	2831	33·62	36	4·70	3·15	3·35	1·84	1·87	2·20	2·34	1·77	2·48	2·60	3·17	3·81	107·1	12·0	10 April	6 November.
Tumut	900	31·96	21	2·66	1·39	2·60	2·54	2·50	4·30	3·07	2·97	2·84	3·06	2·11	2·21	....	....	Not reported ..	Not reported.
Uralla	3337	33·84	23	4·12	2·88	2·86	2·11	1·93	3·02	2·11	2·28	2·53	2·88	3·26	3·75	102·0	15·0	10 January ..	5 December.
Urana	400	17·10	34	1·00	1·32	1·59	1·45	1·81	2·15	1·34	1·48	1·41	1·65	1·22	·99	117·0	18·4	2 May	6 October.
Wagga	609	21·75	35	1·55	1·39	1·85	1·85	1·99	2·74	1·85	1·97	1·83	2·22	1·66	1·26	119·0	18·4	3 ,, ...	29 September.
Walcha	3387	30·30	28	3·37	2·75	2·67	2·06	1·75	2·56	1·79	1·87	2·32	2·72	2·97	3·32	104·1	10·0	14 February ..	3 December.
Walgett	437	18·97	29	2·04	2·34	1·78	1·52	1·77	1·43	1·09	1·31	1·28	1·36	1·54	1·34	122·2	23·7	29 April	26 September.
Warialda	1224	27·97	29	3·25	3·18	2·90	1·78	1·97	2·00	1·66	1·78	2·24	2·32	2·31	2·72	117·7	16·0	— May	11 October.
Warren	645	18·18	16	1·74	1·62	1·96	1·90	1·47	1·35	1·21	1·49	1·12	1·19	1·26	1·49	....	....	Not reported ..	Not reported.
Wellington	996	23·04	26	1·99	1·56	1·76	1·98	1·99	1·97	1·68	2·06	1·85	2·13	1·90	2·32	111·9	15·0	25 April	1 November.
Wentworth	144	11·79	40	·91	·65	·78	·91	1·17	1·20	·91	1·04	1·05	·96	·97	·95	119·0	25·0	8 May	9 September.
Werris Creek	1246	24·81	18	2·77	2·38	2·52	2·00	1·76	1·92	1·80	2·66	1·66	2·07	2·12	2·34	107·5	30·0	18 ,, ...	28 ,,
Windsor	51	30·94	46	2·93	3·36	3·57	2·82	3·01	3·07	2·31	1·77	2·01	2·06	2·43	2·23	....	....	....	....
Wollongong	56	42·11	33	4·08	4·82	4·20	5·04	3·97	4·58	3·37	2·63	3·87	2·90	2·73	3 02	113·4	31·9	25 June	19 July.
Yass	1626	24·26	26	2·52	1·27	1·94	1·81	1·78	2·69	1·95	2·13	2 03	2·39	1·80	1·97	108·5	21·5	2 March	1 November.
Young	1418	24·59	35	2·01	1·67	2·00	2·10	2·17	3·03	2·28	2·26	2·37	2·46	1·70	1·89	113·9	20·3	20 April	27 December.

* Below zero. † Details incomplete.

FARMERS' CALENDAR.

JANUARY.

North Coast—Richmond-Tweed Section.

Crops to sow—
Maize for green fodder; risky for grain.
Sorghum for green fodder; may also provide grain for poultry and pigs.
Millet for green fodder, cut before seeds ripen for hay for horse-feed; provide grain fairly useful for poultry.
Potatoes—small planting.
Sweet potatoes—small planting.
Pumpkins—sow on small scale.
Marrows—sow on small scale.
Rape—sow as largely as possible for green feed for pigs and dry cows in winter; will sweeten soil for other crops later on.
Grass—after scrub fires Paspalum grass-seed may be sown this month.

Vegetables—sow French beans, Swede and white turnips, red and silver beet, cabbage, lettuce, peas (a few), radish.

Get land ready for oats, barley, and rye for green feed.

North Coast—Clarence-Macleay Section.

Crops to sow—
Maize—for green fodder and silage, risky for grain.
Sorghum—for green fodder and silage.
Millet (Hungarian)—for green fodder—useful as a cleaning crop for foul land.
Pumpkins, grammas, and marrows—sow on small scale.
Sweet potato—plant on small scale.
Rape—sow largely, broadcast, 8 lb. per acre.
Cowpea—sow largely for seed, fodder, or green manuring. For grain, sow 8 to 9 lb. seed in drills 30 inches apart. Broadcast for green manuring, using about 20 lb. seed.

Vegetables—sow French beans, Swedes, lettuce, cabbage, and cauliflowers, silver beet, peas (light sowing), cucumber, squashes, and marrows.

Get land ready for autumn cropping. It will generally prove profitable in this district to put a catch crop of rape or millet in land intended for autumn cropping. This will serve to clear it of weeds as well as to provide some useful fodder.

Hawkesbury-Nepean.

Crops to sow—
Maize—for green fodder and silage. In sheltered situations a quick-maturing variety might mature grain, but risky.
Sorghum—for green fodder and silage.
Millets—when hay is scarce, the rapid growth of millet affords a ready means of replenishing the supply. Hungarian is best for this purpose, while White French can be depended upon to return an abundant yield of grain for poultry.

Vegetables—sow French and butter beans, silver beet, cauliflower, cabbage, leeks, and green bush marrows for late crop; plant out celery and tomatoes.

Get land ready for autumn sowings of cereals, legumes, rape, and for autumn crop of potatoes. The land should be left open to catch any rain, and cultivated whenever a crust forms in order to conserve soil-moisture.

South Coast.

Crops to sow—
Maize—for green fodder and silage, latest safe sowing.
Sorghum—for green fodder and silage, latest safe sowing.
Millets—for green fodder. Hungarian a good variety; makes good hay and chaff.
Potatoes—small planting of quick maturing variety.
Sweet potatoes—cuttings may still be planted.
Rape—sow largely for green fodder for cattle and pigs.

Vegetables—sow all kinds of kidney and French beans, kale, cabbage, cauliflower, cucumber, celery, onions, radish, spinach, and sweet maize.

Get land ready for autumn cropping by breaking up and leaving rough so as to catch any rain. After rains go over area with harrows to check evaporation.

Northern Tableland.

Crops to sow—
Maize, sorghums, millets—can still be sown for autumn green feed or for silage. An early sowing of barley could also be made for cutting, and then be allowed to make a second growth.

If potatoes are put in, they should be only very quickly maturing varieties, such as Early Rose.

Harvesting of the grain crops will be proceeding, as there are generally late crops in this district. As the paddocks are cleared of crop, sheep should be turned in to clean up all weeds, &c.

During the busy harvest, the summer crops, such as maize, potatoes, &c., are apt to be neglected; but all available time should be given to them in the way of cultivation, stirring up the soil after rain to conserve the moisture and to keep down the weeds.

Tableland, Bathurst.

Crops to sow—

Maize for green fodder for autumn use.

Sorghums for green fodder for autumn use.

Millets for green fodder for autumn use.

Potatoes—may be planted very early in month, but it is now almost too late for good results.

Swedes—main crop may be sown.

Barley, Rye, Wheat, Oats } small sowings of any of these crops may be made towards end of month for early winter green fodder.

Vegetables—sow Swedes, French and butter beans. Sow in seed-beds cabbage, Brussels sprouts, broccoli, leeks, parsley. Transplant cabbage, cauliflower, and celery.

Get land ready for autumn cropping. All land from which cereal crops have been harvested should be ploughed lightly, or cultivated as early in this month as possible; moisture is thereby conserved, weeds destroyed, and shed grain given a chance to germinate.

Central-western Slope.

Crops to sow—

Maize—early maturing varieties for green stuff and silage.

Sorghum—early maturing varieties for green stuff and silage.

Potatoes—the second, or autumn crop, for household use should be planted in well-worked, fallowed land. For this crop use small whole tubers rather than pieces of large ones. When planted at this season cut sets rot quickly.

Vegetables—sow French beans, marrows, squashes, and pumpkins.

Get land ready for autumn crops. Keep the fallowed land clean by feeding off and cultivation.

Machinery—see that drills and other planting machinery are in order. Obtain duplicates for worn parts.

Riverina.

Crops to sow—

There are few, if any crops, which can be safely sown this month. All the attention possible should be devoted to the growing vegetables, to keep soil in a condition to conserve moisture.

Get land ready for early sowings of rape and swedes for sheep, and break up or scarify land intended for cereals in autumn.

North-western Plains.

Crops to sow—

Conditions are generally unfavourable this month for sowing any main crops. Special attention in the way of cultivation should be paid to all growing crops to destroy weeds and conserve soil moisture.

FEBRUARY.

North Coast—Richmond–Tweed Section.

Crops to sow—

Japanese millet—sow for green fodder (on high ground).

Maize—sow for green fodder.

Barley— do

Rye— do

Planter's Friend do

To balance these, add a leguminous crop, (say) cowpeas or vetches, alone or with the barley or rye.

Swede turnips—for winter food for dry cows and milkers.

Mangels— do

Carrot— do

Field cabbage— do

Thousand-headed kale— do

Vegetables—sow seed and plant out cab bage, cauliflower, lettuce, celery. Sow beans, peas (a few).

Get land ready for lucerne; choose good spot where soil is deep and drainage is good. Clean up and scratch over an area for sowing grass seed.

After fires, Paspalum seed or rootlings may be planted. Rye and prairie grass seed may be sown.

North Coast—Clarence–Macleay Section.

Crops to sow—

Oats, barley, and rye—sow for green fodder, combine either peas or vetches.

Rape—sow for green fodder.

Swede turnips—for winter food for pigs and cows.

Mangolds and carrots—for winter food for pigs and cows.

Thousand-head kale and field cabbage (in drills)—for winter food for pigs and cows.

Hungarian millet—for green feed or hay.
Paspalum—The best month for sowing seed.
Potatoes—plant largely, varieties Early Rose, Early Vermont, Manhattan, Satisfaction, or Brownell's.

Vegetables—sow Swedes, white turnips, French and butter beans, peas.

Hawkesbury Nepean.

Crops to sow—
Maize—for green feed and silage.
Sorghum—for green feed and silage.
Millet—for green feed, hay, and silage.
Barley—sow either Cape or skinless for green fodder, preferably with vetches or grey field peas for complete ration.
Potatoes—plant autumn crop for market and home use, and to provide seed for spring sowing. Early Rose and Bliss' Triumph do best here.
Rape—sow largely for pig feed and green manure.
Turnips and Swedes—sow towards end of month for market and stock purposes. Drilled 30 inches apart on flat or on ridges, and afterwards thinned to 8 inches in the rows. 2 lb. seed per acre.
Cabbage and kale—sow for field culture.

Vegetables—sow French and butter beans, beet, cabbage, cauliflower, celery, leeks, lettuce, onions, radish, carrots, and parsnips (end of month). Plant out cabbage and celery if weather is favourable.

Get land ready for main cereals, lucerne, and autumn sowings of grass seeds; also break up ground where shade or shelter trees are to be planted.

South Coast.

Crops to sow—
Oats—sow early for green fodder; mix 10 lb. vetches or tares with the seed per acre.
Barley—sow for green fodder with 10 lb. per acre of vetches.
Rye—sow for green fodder Black Winter, good variety, resists drought.
Rape—sow for green fodder.
Millet—sow for green fodder, small sowing.
Field peas and vetches sown with above produce a better balanced ration for stock.
Turnips—sow for milch cows and dry stock.
Mangels—sow for milch cows and dry stock.
Field Cabbage or kale—sow for milch cows and dry stock.

Vegetables—
Sow a little seed of cabbage, cauliflower, lettuce, celery, radish.
Beans—all kinds except broad.
Beet—sow a few rows.
Cabbage plant out.
Celery—plant out.
Leek—plant out a few to keep up supply.
Lettuce—plant out a few to keep up supply.
Mustard and cress—sow to keep up supply.
Onions—sow to keep up supply.
Potatoes—plant a few rows.
Spinach—plant a little seed.

Get land ready for further sowings of above crops; also for lucerne.

Northern Tableland.

Crops to sow—
Barley—A sowing of either Cape or skinless barley for green feed should be made; the latter should be sown more thickly than the former, as it does not stool well.
Rape, tares (or vetches)—for winter feed sow rape or tares. Rape requires fairly rich land which must be well cultivated; the seed requires a fine bed, and should not be covered deeply. It is rather difficult to sow broadcast, but with a drill a more even distribution of seed is obtained; about 3 lb. seed if drilled and 6 lb. if broadcast is sufficient to the acre. Dwarf Essex rape is a good variety.
Rye—this may be sown for green feed, Emerald and Mammoth being recommended in this connection.
Turnips—a sowing of Swedes and white turnips may be made for a general crop this month. Sheep can be topped up on these if desired, and if eaten in the field the manure from the sheep will make up nearly all the plant-food taken from the soil; if taken off for sale, turnips are an exhausting crop.

Vegetables—If any seedlings of cabbage or cauliflower have been raised they should now be planted out in rich, well-worked land, and the land kept free from weeds and well hoed. Onion seed may be sown on carefully-prepared land. Sow thinly in drills; keep free from weeds, and thin out later.

Get land ready for grasses and lucerne.
Every endeavour should be made to prepare for the coming sowing season. Where the land is intended for wheat, and is clean and free from weeds, a deep ploughing will be found the best; then, later, a second shallow ploughing will put the land in the best condition for seeding. On the other hand, if the land is at all dirty, a shallow ploughing, just sufficient to germinate

the weed seeds, is the practice recommended. The growth that will result from this ploughing should be eaten off with sheep, or be buried by a second ploughing. The importance of getting the land clean cannot be over estimated, and no clod should be left unturned to achieve this end.

Tableland, Bathurst Section.

Crops to sow—

For the main winter green fodder sow barley, rye, wheat, or oats, the first two for preference.

Rape should be sown largely. A mixture of rape and barley or rape and rye in alternate drills is preferable to rape alone. Swedes may still be sown. Sow kale, lucerne, and black tares in well prepared land towards end of month. Sow onions in seed boxes to be afterwards transplanted.

Vegetables—sow in seed beds onions for main crop. Sow cabbage, Brussels sprouts, broccoli, leeks, and celery. Transplant cabbage, broccoli, leeks, celery, and eschalots. Make a small sowing of carrots.

Central-western Slope.

Crops to sow—

Rape—for early grazing and green stuff.	
Mustard—	do
Barley—	do
Rye—	do
Tares (or vetches)—	do

Early sown crops of rape are likely to be attacked by aphis; to keep the pest in check the crop should be kept fed off until cool weather sets in. Barley or mustard, sown with rape, tends to reduce the danger of "bloating" when stock are first put upon the crop.

Vegetables—sow French beans, radish, peas, turnips, and swedes. Sow cabbage and cauliflower seed in pots or boxes for transplanting later on.

Get land ready for autumn crops by breaking up stubble or new land, and by working the fallows to check weeds and evaporation.

Machinery—If the planting machinery was not attended to last month, it should at once be put in thorough order, and duplicates for worn parts obtained.

The **seed wheat** intended for planting during the current season can be treated and dried in readiness, if bluestone is to be used. When the formalin treatment is adopted, it is advisable to delay treatment until just before planting.

Riverina.

Crops to sow—

It is rather early for sowing any of the main crops yet. All the time possible should be devoted to preparing land for—

Rape—for green feed, which may be sown in fallowed land or after showers.

Oats—for green feed, and for hay or grain.

Wheat—for green feed, then for hay or grain.

Swedes and turnips—sow if weather be favourable.

Vegetables—sow cabbages and cauliflower in seed-beds for transplanting later on. If soil is sufficiently moist, sow white turnips and Swedes. Growing crops will need especial attention, and if weather is dry, an occasional watering. In applying the water, stir up the soil beforehand, and then cover the moist ground with a mulch of old straw, leaves, or anything that will help to conserve the moisture.

North-western Plains.

Crops to sow—

Not a favourable month for sowing any main crops suitable to district.

Vegetables—cabbage and cauliflower seed may be sown to provide young plants for setting out towards the end of March.

Other work—should the weather permit, ploughing may still be done for crops that are to be put in late in May or in June, but this is usually a very wet month, and work on the land is impossible. Now is a good time to do any repairs and painting of implements, sheds, and outbuildings, cleaning and dipping seed for the prevention of smut, and the hundred and one little jobs that have been left until a slack time. Sometimes a few days may be put in straightening up and repairing fences, and hoeing Bathurst burrs and roley poleys in grass paddocks. These should be stacked as soon as cut, and burnt directly they are dry enough. If left until later, the seed will ripen and be scattered whilst being cut, which means extra labour and expense next year.

MARCH.

North Coast—Richmond–Tweed Section.

Crops to sow—

Sorghum—sow a little for green fodder

Oats—sow as much as desired for green fodder.

Barley—sow as much as desired for green fodder.

Maize—sow for green fodder.

Rye—sow for green fodder.

Rape—sow for green fodder for pigs and dry cows.

Buckwheat—sow for seed for poultry.

Field Peas—, Vetches— { sow alone, or in combination with oats, rye, or barley, as winter food for milch cows.

Potatoes—plant largely as desired.

Grasses—sow cocksfoot, rye grasses, and prairie.

Clover—sow white or Dutch.

Vegetables—cabbage, cauliflower, onions (sow seed and transplant any seedlings available), peas, globe artichokes.

Get land ready for lucerne. (See February.)

North Coast—Clarence–Macleay Section.

Crops to sow—

Oats—sow for green fodder.

Barley— do

Wheat—sow for green fodder (the macaroni varieties) such as Galland's hybrid, Medeah, Farrer's Durum.

Rye—sow a small area for green feed.

Field Peas—sow to raise seed supply for future combination cereal crops for fodder.

Rape—sow for green fodder and pigs.

Potatoes may still be planted, but on very small scale.

Lucerne—sow 15 to 20 lb. broadcast per acre.

Grasses—The best month to sow grasses of all kinds.

Vegetables—cabbage, cauliflower, onions, peas, globe artichokes.

Hawkesbury–Nepean.

Crops to sow—

Hungarian millet may be sown for green feed or silage early in the month.

Wheat—sow for green forage, for which the macaroni varieties are the most suitable. Farrer's Durum and Medeah do best here, and if cut early, before the heads become harsh, the ensuing crop furnishes a good yield of hay. Other hay wheats are Plover, John Brown, and Comeback, which yield well and are fairly rust-resistant.

Oats—sow for green feed, in conjunction with vetches or field peas. Potato and White Tartarian are heavy yielders.

Barley—sow for green feed.

Rye—on poorer soils where other cereals fail to flourish rye may be grown for stock feed, provided it is cut before the seed is ripe.

Rape—sow largely for pig feed and green manure.

Turnips, Swedes, kohl rabi, tree-kale, and thousand-headed kale may be sown.

Field carrots may be tried for stock use.

Vegetables—sow French beans (sparingly), broad beans, beet, cabbage, cauliflower, celery, lettuce, leeks, peas, radish, and eschalots.

Get land ready for sowing grasses and lucerne, and for planting out shelter trees. Dig or plough in all available farmyard manure.

South Coast.

Crops to sow—

Oats and vetches, Barley and vetches, Wheat and vetches, Rye and vetches { (or field peas) for green fodder. It is advisable to sow a large area with these crops for winter fodder for dairy cattle.

Rape—for pigs and dry cattle.

Turnips, Swedes, and Kohl Rabi—for winter fodder.

Lucerne—sow extensively, as this is the best time of the year if weather is favourable; if land is dirty, sow in April.

Grasses—sow cocksfoot, rye grasses, Prairie, Rhodes, Paspalum dilatatum, Phalaris commutata, meadow fescue, Kentucky blue grass, rib grass, and Texas blue grass.

Clovers—sow white Dutch, red, strawberry, New Zealand red clover, and New Zealand cow grass.

Sheep's burnet should receive a trial.

Vegetables—

Sow broad beans towards end of the month.

Beans, French or kidney—risky to sow; a few drills may be tried.

Beet, red—sow a little seed to keep up supply.

Borecole or kale—sow extensively.

Cabbage, broccoli, Brussels sprouts, and cauliflowers—sow extensively.

Celery, cress, and mustard, also endive —sow a little seed.

Leek—sow extensively.

Peas may be sown.

Eschalots, Potato-onion, tree-onion, and garlic—plant a few sets.

Get land ready for a further sowing of above crops. Take special pains to prepare a fine, deep, clean seed-bed for lucerne.

Northern Tableland.

Crops to sow—

Rape may be sown for feeding stock in winter. Dwarf Essex, a favourite variety, about 6 lb. per acre is sufficient to sow broadcast.

Barley may be sown for green feed. Cape or skinless, two of the best, may be sown with tares or vetches if required.

Rye may also be sown with tares for green food or for hay, if cut early.

Clovers for feed or hay may be planted end of the month.

Field peas may be sown alone, or in conjunction with barley or rye.

Lucerne—The latter part of March is a good time to sow lucerne to enable roots to establish themselves well into the soil before cold weather sets in. The seed should be bright, and of a yellow colour; if too dark a shade, it is not a good sign. Sow from 12 to 15 lb. of good seed. Plough deeply, and prepare seed-bed thoroughly; and most important of all, see that the land is clear of weeds. Choose deep rich alluvial soil where possible, with an open subsoil. Where the land is clayey, see that it is well drained; but if possible, avoid cold stiff subsoils.

Get land ready for early wheats. Procure good seed to sow in this connection.

Dr. Cobb, states:—"The advantages of large, plump, graded seed are that: It is likely to be healthier seed, and therefore more likely to produce healthy plants. It can be sown more evenly on account of its uniform size. There is a larger percentage of growth and fewer failures. The plants from such seeds are larger and thriftier, and more resistant to disease, drought, and starvation. The crops from such seed have a more even growth, and are more economical to harvest and thresh. The yield per plant, both of grain and straw, is greater from such seed. The crop of grain grown from such seed has a higher market value, because—

"(*a*) It contains more large grains and fewer small grains.

"(*b*) It is plumper and better looking.

"(*c*) It weighs more per bushel.

"The continuous use of such seed tends towards a general improvement in the quality of wheat."

Tableland—Bathurst Section.

Crops to sow—

Wheat—The earliest sowing of this cereal for the main crop may be made about the end of the month, if it is intended to graze sheep upon it during winter. The lighter portions of the farm should be chosen for this purpose. Late maturing varieties should be used.

Barley, rye, and rape should still be sown early in the month for green fodder.

Sow kale, white mustard, clovers, black tares, field peas, grasses, and sheep's burnet.

The main crop of lucerne may be sown this month upon well prepared land.

Sow onions for main crop.

Vegetables—sow onions, leeks, eschalots, Savoy cabbage, broccoli, mustard and cress. Make a small sowing of carrots. Transplant Savoy cabbage, broccoli, onions, leeks, and eschalots.

Central-western Slope.

Crops to sow—

Rape—for grazing and green stuff.
Kale— do
Mustard— do
Oats / Barley } with tares or vetches.

Crimson clover—for grazing and green stuff.

Wheat—for green fodder and silage.

Rape—This is the most favourable month for the main crops of rape, though the sowing can be continued as late as May.

Kale does not grow as quickly, and is rather more difficult and expensive to grow than rape, but it has the advantage of providing grazing for a month later.

The first sowings of wheat can be made towards the middle of this month, but unless particularly late varieties are sown, the crops planted now will become winter proud, and will require to be eaten off.

Vegetables—sow cabbages, cauliflowers, onions, carrots, parsnips, turnips, swedes, and peas.

Get land ready for lucerne, and finish the preparation of the land intended for wheat, oats, and barley.

Riverina.

Crops to sow—

Clover and trefoil, prairie grasses.

Rape—sow as largely as desired.

Oats—for greenstuff, hay, and grain.

Barley—for green fodder, with or without peas or vetches.

Sow wheat for hay after the first week in the month. Sow lucerne in land which has been fallowed and kept free from weeds.

Vegetables—sow cabbage, cauliflower, carrots, parsnips, beet, turnips, Swedes, onions, and a few rows of peas.

Get land ready for wheat for hay, then for wheat for grain, and barley for grain.

North-western Plains.

Crops to sow—

Barley for winter feed (skinless being the best), grass, lucerne, rye, and **field peas.**

Vegetables—cabbage and cauliflowers sown last month may be planted out if the weather is not too hot, otherwise they had better be left in the seed-bed where they can be shaded until the weather begins to cool off; sow seeds for succession.

Get land ready for sowing wheat, oats, barley, rye, and lucerne. By fallowing and working the surface at this stage, the soil will be got into good condition by April, and weeds which at this stage commence to grow luxuriantly will be checked, and the majority got rid of by scarifying; keep going at the Bathurst burrs.

APRIL.

North Coast—Richmond–Tweed Section.

Crops to sow—

Oats—sow for green stuff and also for hay.

Rye—sow for green stuff.

Lucerne—make main sowing.

Rape—sow for winter feed for pigs and cattle.

Field peas—sow for cattle feed, and seed for poultry and pigs.

Potatoes—plant, but not too largely.

Vegetables—plant out roots of rhubarb, cabbage, lettuce; sow broad beans, peas, onions, turnips.

North Coast—Clarence–Macleay Section.

Crops to sow—

Oats—for green stuff, and also for hay.

Rye—for green stuff.

Wheat—for grain, sow macaroni varieties.

Field peas—sow for cattle and pig feed.

Linseed—sow for seed for calf feeding.

Lucerne—sow largely. This is the best month for this crop.

Rape—sow for winter feed for pigs and cattle.

Thousand-headed kale and cattle cabbage—in drills 3 feet apart, for pig and cow feed.

Swedes—sow for market and stock.

Grasses and clovers—sow exotic grasses and clovers.

Vegetables—sow French beans, cabbage or cauliflower, carrot, onions, peas, and herbs.

Hawkesbury–Nepean.

Crops to sow—

Wheat—sow, as in March, for green feed and hay. For grain Bobs, Federation, and Thew have given good results.

Oats—sow largely for hay, Algerian has proved most suitable for this district; sow with peas and vetches for green feed.

Barley—for grain for pigs and poultry, and for green feed.

Rye—for green feed and grain.

Turnips, Swedes, rape, and kale—may still be sown.

Mangolds are sown on rich ground for stock feeding.

Lucerne—make main sowing in well prepared soil.

English grasses and clovers—sow either in well cultivated land or in roughly scratched-over pasture, if weather be favourable.

Field peas and vetches—may be sown for pig feed or green manure.

Sheep's Burnet has proved worthy o trial for augmenting the fodder in worn-out pastures in this district.

Tree planting—for shade, shelter, and ornament—should receive attention this month. Non-deciduous trees, such as peppers (very early in month), pines (various), kurrajong, silky oak, camphor laurel, river oak, juniper, carob bean and bunya bunya may be planted out. Hedges should also be planted out. The seeds of such trees as pines, cedars, oaks, walnuts and chestnuts should be sown as soon as possible after ripening, but not later than April.

Vegetables—sow broad beans, carrots, parsnips, leeks, onions, lettuce, parsley, peas, eschalots, and herbs; winter rhubarb may be planted out.

South Coast.

Crops to sow—

Oats—for hay crop.

Wheat— do

Fodder Crops—a further sowing of al fodder crops should be made, as described in March.

Lucerne—when weeds are numerous, April sowing should be preferred to March sowing for main crop.

Grasses—sow extensively all grasses except Paspalum, as this seed requires moisture and heat to germinate.

Clovers—sow largely all clovers.

Get land ready for main crops of oats and late crop of wheat, also late crop of green fodder.

Vegetables—

Broad beans—sow extensively, 3 feet apart and 5 inches in drills.

Beet, red—sow a row or two.

Kale, Brussels sprouts, cabbage, cauliflower, carrots, celery, endive, leek, onions, eschalots—should be sown.

Get land ready for planting shade trees. This is a matter of great necessity on many farms where cattle have no protection from the summer sun and bleak winter winds.

Northern Tableland.

Crops to sow—

Wheat—the end of the month is a good time to sow wheat here, especially sorts that take a long time to mature —such as the Manitobas.

Barley, rye, or oats may be sown for green fodder. Cape and skinless are two good sorts. Sow the latter thickly, as it is a poor stooler.

Lucerne may also be sown, although it is getting late.

Tares, vetches, &c., may be sown in combination with rye or barley. The former are good for ploughing in in orchards during the winter months.

Artificial manures—The subject of manuring land must largely engage the attention of our farmers in the near future, as it is evident much soil is being depleted rapidly of plant-food essential to our principal crops.

When farm-yard manures are not obtainable there is no doubt of the value of artificial manures when intelligently applied, but putting them in irrespective of the nature of the soil—whether the land has been cropped for a number of years, or new land, and applying much more than a sufficient quantity of what the crop intended to be grown requires—is a mistake, and must eventually end in loss.

Ill-drained lands and soils in bad mechanical condition cannot be expected to benefit much by the application of manures. Soil must have proper treatment; it must be ploughed deeply at least once in the year, and the top brought into a fine state of tilth. It must be drained when necessary. It should be *limed some time before* in sour land and in heavy clay. Some soils require green crops ploughed in to supply humus. It is pointed out that the growth of a plant is determined by supplies of essential food readily available that is soluble, for they are only taken up and used by plants in this way. Generally speaking, farmers want the result on the crop the manures are sown with, and this is where superphosphates for wheat and sulphate of potash for potatoes come in. If manures not easily soluble are applied, then the preceding crop should be manured in order to benefit the succeeding one.

Before attempting to manure, a farmer should either find out for himself, by small experiments, what essential plant-food his soil is deficient in, or send samples of the surface soil and subsoil to the chemist, Agricultural Department, for analysis.

Nitrogenous ingredients can generally be done without, as nitrogen can be more cheaply conserved by growing leguminous crops and ploughing them in.

Manures for grain are much more efficiently applied by the drill than by being broadcasted. Manure the crop, and not the land. Apply what is ample for the former requirements, and no more, for artificial manures are expensive.

Vegetables—sow onions towards the end of the month, also cabbages and cauliflower.

Get land ready for main crops of cereals and hay.

Tableland—Bathurst Section.

Crops to sow—

Wheat—as much as possible of the main crops should be sown. Sow the later maturing varieties first upon the poorer portions of the farm.

Barleys can be advantageously sown towards the end of the month for the main crops.

Oats can be sown freely this month, comparatively early sowing frequently ensures good plump grain.

Rye may be sown for the main crop; it thrives upon very light soils.

Lucerne may be sown for the main crop.

Linseed may be sown; it requires soil in good condition and free from weeds.

Kale, scarlet clover, black tares, field peas, sheep's burnet and grasses may be sown.

Vegetables—transplant onions, savoy cabbage, broccoli and eschalots. Sow savoy cabbage and herbs. Make small sowings of spinach, lettuce, and radish. Transplant strawberries.

Central-Western Slope.

Crops to sow—

Lucerne—in a well-prepared seed-bed.
Wheat—for hay and grain.
Oats— do
Barley—for green stuff, hay and grain.
Rye— do
Rape—for grazing.
Tares or vetches—for grazing.

Crimson clover—for grazing,

This and next month comprise the busy planting months, when operations should be pushed on with vigour, as the weather permits.

Vegetables—sow peas, onions, carrots, parsnips, turnips, swedes, cabbages, and cauliflowers, and transplant any seedlings available.

Get land ready for the final sowings of wheat. Keep the ground between the drills of rape and other growing crops loose to conserve moisture, kill weeds, and stimulate growth of crop.

Riverina.

Crops to sow—

Wheat—for hay and grain.

Rape may still be sown on a small scale.

Barley—for grain, and in combination with tares and green stuff for silage.

Lucerne—sow as much as land is well prepared for.

Clover and Trefoil can be sown this month.

Vegetables—sow a moderate area of peas and broad beans, also cabbages and cauliflowers for future transplanting. Transplant cabbages and cauliflowers as they become fit. Sow onions, carrots, parsnips, and white turnips.

Get land ready for the wheat grain sowing which it is desirable should be completed during next month.

North-western Plains.

Crops to sow—

Wheat, Oats, Barley, Lucerne, Grass, Rye, in fact any of the hardy winter crops.

Vegetables—plant out cabbages and cauliflowers and sow seed for later plantings; sow broad beans. There will be plenty of weeds this month; keep scarifiers and hoes going.

Get land ready for sowing next month. The soil should be worked well down with harrows or cultivator.

MAY.

North Coast—Richmond-Tweed Section.

Crops to sow—

Oats—sow for hay and, with field-peas, for green feed.

Barley—sow for green feed, also some for poultry and pig grain.

Rye—sow for green feed, also some for poultry grain.

Lucerne—sow small patch.

Grasses and Clover—sow, but it is getting late.

Vegetables—sow broad beans, peas, lettuce, cabbage, cauliflower, turnips, and carrots and plant out a few rhubarb roots.

Get a small plot trenched and well prepared for asparagus.

North Coast—Clarence-Macleay Section.

Crops to sow—

Oats—sow for hay and green feed.

Barley—for green feed.

Rye—for green feed

Rape—for green feed for pigs, sheep, and cows.

Lucerne—if weather is favourable.

Vegetables—rhubarb roots, plant out; asparagus beds, top dress with stable manure; peas, sow a full crop; cabbage, cauliflower, turnips, lettuce, carrots.

Hawkesbury-Nepean.

Crops to sow—

Wheat—sow quick-maturing varieties for green feed, hay, and grain.

Oats—main crop for hay.

Barley—green feed, and for pig and poultry grain.

Turnips, Swedes, and Rape—when weather conditions have been unfavourable for previous sowing, this may be done now.

Vegetables—sow broad beans, carrots, leeks, lettuce, onions (for pricking out), parsley, herbs, peas, and eshalots. Plant out asparagus roots, though June is preferable.

Get land ready for late sowings of wheat and rye for winter green feed. Do not have any idle paddocks or patches to grow weeds. Break up the soil and pop in any of the above-mentioned crops for a little green feed at a time when the grass paddocks in this district get very bare.

South Coast.

Crops to sow—

Oats—main crop, Algerian, Argentine, and Tartarian.

Wheat—late crop.

Barley—small sowing of Cape Barley and field peas.

Rye—small sowing of Thousand-fold, Black Winter, and Emerald.

Turnip and Sweeds—late sowing.

Rape—further small sowing.

Lucerne—may still be sown.

Grasses—late sowing of pasture grasses and clovers.

Vegetables—broad beans, sow largely; broccoli, cabbage, cauliflower, lettuce, leek, parsley, small sowing; peas and turnip, sow largely.

Get any idle land ploughed roughly and exposed to the action of frost for potatoes and other crops in spring.

Shade Trees, Shrubs, and Hedges—if not on hand, send early order to nursery to be delivered in June or July. See that the soil, where trees are to be planted, is deeply and roughly broken up, so as to get a chance to sweeten before the young trees are set out.

Northern Tableland.

Crops to sow—

Wheat—Late maturing varieties may be sown early in month.

Barley—for green fodder.

Rye— do do

[See directions for April.]

In view of the severity of the winter in this district, no effort should be spared to provide abundance of winter fodder, and especially in the form of silage, as the most nutritious and succulent substitute for grass.

Get land ready for the main sowings of cereal crops next month.

Tableland—Bathurst Section.

Crops to sow—

Wheat—the sowing, if possible, should be completed this month.

Barleys—The main crops for grain for malting and other purposes should be sown.

Oats and Ryes may be sown to advantage.

Lucerne may still be sown, preferably early in the month.

Linseed, clovers, tares, field peas, sheep's burnet, and many grasses may be sown.

Vegetables—Transplant onions, Savoy cabbage, broccoli, and eschalots. Plant tree onions, potato onions and garlic. Make small sowings of peas and broad beans. Transplant strawberries.

Ewes should be shorn around crutches and udders.

Central-western Slope.

Crops to sow—

Lucerne—in a well-prepared seed bed.

Wheat—for hay and grain.

Oats— do do

Barley—for greenstuff, hay and grain.

Rye—for greenstuff and grain.

Rape—for grazing

Tares— do

Crimson clover—for grazing.

This is one of the busiest and most favourable planting months. Operations should be pushed forward with vigour as the weather permits.

Vegetables—

Sow peas, onions, parsnips, carrots, swedes, cabbages, and cauliflowers; and plant out any seedlings available.

Get land ready—for final sowings of wheat. Keep the soil between the drills of rape and other growing crops loose to conserve moisture, kill weeds, and stimulate growth.

Riverina.

Crops to sow—

Wheat—this is the best month for main sowings of grain crops.

Barley—for grain.

Field peas—for green feed or pulse.

Vetches or tares—for green feed.

Rape—for green feed.

Vegetables—plant tree onions, potato onions and eschalots. Make a final transplanting of cabbages and cauliflowers. Sow peas and broad beans as largely as required.

North-western Plains.

Crops to sow—

Wheat and Oats—for hay and grain.

Barley—for green feed or grain.

Vegetables—plant out and sow seed for a succession of cabbages and cauliflower; sow broad beans.

Get land ready for spring sowing of maize, sorghum, and other green fodder and silage crops. At this stage the area should be ploughed and left rough, so that the weather may effect its fullest influence in mellowing it during the winter months.

JUNE.

North Coast—Richmond-Tweed Section.

Crops to sow—

Oats—sow for green fodder; not too late for a hay crop.

Rye—sow for green fodder; limited market for rye straw.

Vegetables—sow broad beans; plant out a few cauliflowers, cabbages, endive, lettuce, radish; plant chokos.

Get land ready for potatoes and for artichokes for domestic use and fodder. This crop is a useful one to be harvested by pigs.

North Coast—Clarence-Macleay Section.

Crops to sow—

Oats—sow for hay and green feed.

Rye—for green feed.

Wheat—for green feed and grain (Macaroni variety).

Vegetables—sow peas, beans, cabbage, broccoli, leeks, lettuce, onions, and herbs.

Get land ready for main crop of potatoes and early maize by deep ploughing.

Hawkesbury-Nepean.

Crops to sow—

Wheat—sow only quick-maturing varieties, such as Thew, Bobs, and Steinwedel.

Oats—Algerian for hay and coarser varieties (White Tartarian or Abundance) for green feed.

Barley—for green stuff may still be sown for succession.

Rye—late crops of Emerald and Thousandfold are worth a trial on the poorer classes of soil.

Onions should be transplanted.

Vegetables — sow broad beans, cabbage, leeks, parsnips, peas, and herbs.

Get land ready for potato main crop and maize. Spread all available farm yard manure on the ground and plough in to mellow.

South Coast.

Crops to sow—

Oats—continue sowing main crop.
Wheat—small sowing for late crop.
Barley— do do
Rye— do Black Winter.
Vetches and Peas—small sowing.

Vegetables—beans broad, cabbage, cauliflower, leek, lettuce, onions, parsnip, peas, radish, plant a few rows of each.

Get land ready for use in spring for potatoes, and maize; sorghum, millets, cowpeas, and other crops for green fodder and silage.

Northern Tableland.

Crops to sow—

Wheat—main sowings may be made this month. Varieties that have proved valuable here are Jonathan, John Brown, Power's Fife, and Sussex.

Oats may be sown towards end of month for hay or grain.

(See July notes.)

Tableland—Bathurst Section.

Crops to sow—

Wheat may still be sown, although somewhat late to give best results; an application of superphosphate would overcome in some measure the lateness of sowing.

Oats, Barleys, and Ryes may be sown.

All land for summer crops should be ploughed as soon as possible.

Vegetables—sow peas and broad beans for main crop. Sow in seed-beds, cabbage. Transplant cabbage and herbs. Plant out tree onions, potato onions, garlic, eschalots and rhubarb. Transplant strawberries.

Central-western Slope.

Crops to sow—

Wheat—late plantings of early maturing wheats may be made on well-prepared land up to the end of the month with a prospect of getting profitable, though not maximum, returns.

Vegetables — sow cabbages, cauliflowers, carrots, parsnips, turnips, and peas. Transplant cabbages, cauliflowers, and onions.

Machinery—overhaul ploughs and obtain necessary duplicates for winter fallow ploughing.

Get land ready for planting out shade and shelter trees where necessary.

Riverina.

Crops to sow—

Wheat—it is now late for wheat, and sowing of ordinary varieties cannot be safely extended beyond first week of this month except in favourable localities. Where delay has occurred early varieties only should be sown.

Barley may still be sown for green fodder on a small scale.

Vegetables—sow carrots, parsnips, lettuce, broad beans, white turnips, peas, and onions in limited quantities only where water will be available.

Get land ready for sweet potatoes, lucerne, sheep's burnet, and for final sowing of barley for fodder.

North-western Plains.

Crops to sow—

Wheat and Oats—for hay.

Vegetables—plant cabbage and seed carrots, broad beans, lettuce, and spinach.

Other Work—continue to plough land that is to be sown in the spring; the frost will kill most of the couch grass that is ploughed up now.

JULY.

North Coast—Richmond–Tweed Section.

Crops to sow—

Rape may be sown on small scale.

Potatoes—sow main crop towards end of month.

Onions—sow on small scale.

Vegetables—sow broad beans, silver beet; plant out cabbage, cauliflower, endive, lettuce; tomatoes for early planting

Get land ready for early spring sowing of maize, sorghum, teosinte, and millet; also for lucerne.

North Coast—Clarence-Macleay Section.

Crops to sow—

Macaroni wheats may still be sown.

Potatoes—sow main crop towards the end of this month. Use 2 oz. sets and preferably cut from medium-sized tubers.

Vegetables—sow silver beet, tomatoes. Plant out cabbage and cauliflower. Canadian Wonder beans may be sown about the middle of month to catch early market.

Get land ready for spring cropping. Turn in any stable manure or other coarse manure, so that by the time the crops are planted, it may be incorporated with the soil.

Hawkesbury-Nepean.

Crops to sow—

Limited areas only of oats, rye, and rape.

Onions—as a field crop, if sown where they are to grow, should be sown this month on ground brought to an extremely fine tilth. If transplanted, they should be sown much earlier (May or June).

Vegetables—sow tomatoes, cucumbers, and melons under good shelter, and set out sweet potato tubers under frames or glass to secure stocks of rooted cuttings for early planting. Sow a few carrots, lettuce, radish, onions, and peas. Plant out Jerusalem artichokes, asparagus, and summer rhubarb.

Tree planting of deciduous kinds for shade should be completed.

Get land ready for potatoes. Plough in any fresh stable manure so that it will be mellowed before planting time. It will be well to break up and expose to atmospheric influence land intended for early maize crops.

Prepare new ground for cropping by deep ploughing so that frosts may act beneficially upon the soil, and couch and other tenacious perennial growths may be destroyed.

South Coast.

Crops to sow—

Oats—late sowing for hay.

Barley—late sowing for fodder and seed.

Rye—late sowing for fodder.

Field Peas—late sowing for fodder, with barley or rye.

Tares—late sowing for fodder, with barley or rye.

Vegetables—

Beans, French—risky to sow.

Carrots.

Sow a little seed of cauliflowers, leek, lettuce, onions, parsnips.

Peas—sow largely.

Swedes—sow a little seed.

Tomato—sow a little seed in boxes.

Shelter trees and hedges—plant out largely. Collect stable manure and cart straight out to paddocks and spread on land to be ploughed in for spring crops.

Northern Tableland.

Crops to sow—

Oats may be sown this month either for grain or hay; they do well on the heavier moister land of the district, which is not so good for wheat and barley. The Algerian variety is rapidly coming into favour; it makes a good sweet hay, and is a heavy grain yielder. Red Rust-proof is perhaps the best hay sort for New England, and appears to be earlier than any other variety yet tried; it grows a longer straw than Algerian, which it much resembles. White Tartarian is another good yielder, both of straw and grain; it makes hay of a beautiful colour, though not so sweet as Algerian and Red Rust-proof; it is, however, a good chaff sort. Surprise is a fair yielder and good feed oat, and does well here. Danish Island, a really good all round oat, a heavy grain yielder, and good for hay and chaff.

Wheat—this is a late district, so wheat may still be sown, but sow more thickly than earlier in the season. Jonathan, John Brown, Sussex, and Power's Fife (a Manitoba) are recommended, though the latter, being a late wheat, would be better sown earlier.

Ryes—these may still be sown for green fodder or grain. Emerald Rye is a good feeding variety; Thousand-fold and White Rye have also done well The latter is the best for collar-making.

Vegetables—cabbage, peas, cauliflowers may be sown.

Get land ready for spring crops by giving it a good deep ploughing at this stage.

Bathurst Section.

Crops to sow—

Oats and Ryes—may be sown, but, generally speaking, they should be in. It is debatable whether August sowing would not be preferable for any that were not sown in June. The land is cold during this month and growth is at its minimum. Crops which move at once after sowing have better chances, and such is more generally the case if sown in August or early September rather than in July.

Vegetables—sow peas and broad beans. Sow in seed-beds cabbage and early cauliflower; transplant cabbage, herbs, rhubarb, eschalots.

Get land ready for spring cropping. Plough deeply and work in any available crude farmyard or stable manure.

Central-western Slope.

Crops to sow—

This is not a good month for sowing any farm crops.

Vegetables—transplant cabbages and cauliflowers; sow tomato seed and plant sweet potatoes in cold frames or under cover.

Get land ready for spring crops of lucerne and potatoes. For potatoes an application of stable manure will be of great benefit to enable this crop to withstand drought.

Commence to break up the stubble land for summer and autumn grain and grazing crops, such as rape or tares.

Riverina.

Crops to sow—

Sheep's Burnet—sow in cultivated paddocks or bare patches, such as filled rabbit burrows in limited area.

Barley—sow for green fodder only.

Vegetables—transplant cabbage and cauliflower, and sow seed for later use. Sow tomato seed and plant sweet potatoes under cover for early plants.

Get land ready for lucerne, permanent grasses, and for potatoes. Plough land to lie fallow for wheat, barley, oats, &c., to be sown in autumn.

North-western Plains.

Crops to sow—

Wheat and oats for hay.

Vegetables—sow and plant cabbage, broad beans, carrots, and spinach.

Other work—finish ploughing land that is to be sown in the spring.

AUGUST.

North Coast—Richmond-Tweed Section.

Crops to sow—

Oats—sow for green fodder.
Barley—sow for green fodder.
Rye—sow for green fodder.
Potatoes—plant out on small scale.
Mangolds—sow in deeply-worked soil.
Maize—sow in well-prepared land.
Grass-seed—sow all kinds except prairie, which does better in autumn.
Arrowroot—tubers may be set out.
Yams—tubers may be set out.
Sweet Potatoes—rooted cuttings may be set out.
Artichokes—tubers may be set out.

Vegetables—sow cabbage, cauliflower, endive, kohl-rabi, lettuce, parsley, garden swedes, turnips, red beets, carrots. Where situation is warm and sheltered, tomatoes may be set out; also French beans. Cucumber seedlings should be raised under shelter for setting out at first opportunity. Chokos may be planted near a fence or other support.

Get land ready for maize, sorghum, broom millet, cucumbers, pumpkins.

North Coast—Clarence-Macleay Section.

Crops to sow—

Early Maize—sow towards end of month, Early Leaming or King of the Earlies.
Mangolds—soak seed all previous night, and sow in drills 30 inches apart.
Lucerne—sow in well-prepared land, but April is the best month for conditions of this district.
Grasses—sow all grasses with the exception of Prairie and Paspalum, which do better in February.
Arrowroot—tubers may be set out.
Sweet Potatoes—shoots may be planted out in drills 3 feet apart.
Artichokes—plant tubers in drills 4 feet apart; the white variety is the most prolific.
Canadian Wonder Beans—sow largely for market.

Vegetables—sow cabbage, cauliflower, endive, kohl-rabi, lettuce, parsley, swedes, turnips, red beets, carrots, parsnips, and tomatoes may be set out.

Get land ready for potatoes. Plough deeply, and as soon as weeds show up cultivate to destroy them. The same applies to land intended for maize, millet, sorghum, pumpkins, and other spring crops. It is better to work any available stable manure into the soil now than put it in at time of seeding.

Hawkesbury-Nepean.

Crops to sow—

Potatoes—main crop. Early Rose, Brownell's Beauty and Bliss' Triumph do best here.
Mangold and Sugar Beets—where frosts are not likely to be severe.

Vegetables—sow French beans, beet, carrots, lettuce; and under shelter, tomatoes, bush marrows, and cucumbers. Set out tomatoes in warm situations; plant out Jerusalem artichokes and summer rhubarb.

Get land ready for maize, sorghum, pumpkins, &c.; land intended for laying down in lucerne should receive a final ploughing and be left rough till end of month.

South Coast.

Crops to sow—

Lucerne may be planted at end of month.
Rye, Oats, Rape—small sowing.

Vegetables—asparagus, artichokes, beans (French and kidney), beet, all cabbage family, celery, turnips (rooted), carrots, lettuce, leek, onions (extensively), parsnips, peas, potatoes, radish, rhubarb and turnips.

Get land ready for sowing grasses, potatoes, maize, sorghum, millet, pumpkins, and melons.

Northern Tableland.

Crops to sow—

Barley may be sown for green feed, and skinless barley may also be sown for hay purposes.

Rye—may be sown for green fodder. Emerald Rye has been found best here so far for this purpose. Ryes if cut very early—just when they are coming into head—make very fair hay if properly cured.

Wheat—may still be grown here for hay. Sow thickly. Very late for grain, but in this late district a fair crop is still possible. When wheats are well rooted, but show signs of going back through dry weather, harrow them with a light harrow, and if the lever harrows are used turn the tines backwards towards the driver. If the grain has been drilled in, harrow across the drills rather than in the direction they are planted, as less plants will be torn up in the operation.

Oats may be sown on the New England tableland with advantage this month or even later; but, as with other cereals, sow thicker as the season advances. Algerian, Red Rust-proof, Danish Island, Tartar King, Golden Giant, White Tartarian, and Surprise have been tried at Glen Innes with successful results.

Vegetables—peas may be sown with advantage this month. Onions may be sown and any young plants transplanted.

Get land ready for all spring crops such as maize, sorghums, millets, cowpeas, pumpkins, melons, cucumbers, &c., and other spring vegetables.

Tableland—Bathurst Section.

Crops to sow—

Oats, ryes, field-peas, tares, kale, and grasses may be sown.

Lucerne—may be sown upon well-prepared land if moisture has been conserved. Upon soil not properly fitted spring sowing of lucerne is risky. It is preferable to sow during the autumn. Sow tobacco at end of month in seed-beds which can be covered from frosts.

Stock should be taken off all lucerne paddocks. The surface should be loosened by spike roller or other implement.

Vegetables—sow carrots, parsnips, turnips, broad beans, peas, lettuce, beet, and radish. Sow in seed-beds cabbage, Brussels sprouts, early cauliflower, tomatoes, capsicums, cape gooseberries and egg plants. Transplant asparagus, rhubarb, cabbage, lettuce, early cauliflower, and eschalots.

Central-western Slope.

Crops to sow—

Lucerne—sow early on well-prepared land.

Potatoes—plant after the middle of the month.

Vegetables—transplant cabbage and cauliflowers; plant tomatoes in seed boxes or beds.

Cultivation—continue the preparation of land for summer crops and for fallowing.

Riverina.

Crops to sow—

Lucerne—sow early in month in well-prepared land.

Potatoes—commence planting.

Grass—transplant roots of Paspalum, but it is not generally so successful as some of the native grasses, or Rhodes grass, which can be propagated by rootlings.

Vegetables—sow peas on small scale, and tomato seed; cucumbers.

Get land ready for millets, sorghum, maize, sweet potatoes, pumpkins, melons, sugar beets, mangolds, and other small patches of spring crops for pig, sheep, or cattle fodder. Plough land to lie fallow for wheat, barley, oats, &c., to be sown in the autumn.

North-western Plains.

Crops to sow—nil.

Vegetables—sow broad beans, carrots, and spinach; also, tomatoes, marrows, squash, cucumbers, pumpkins, and Cape gooseberries if they can be sheltered at night from the frost.

Get land ready for planting next month by harrowing to reduce soil to fine tilth.

SEPTEMBER.

North Coast—Richmond-Tweed Section.

Crops to sow—

Maize—for grain.

Sorghum—for green fodder and grain.

Millets—for green fodder, hay, broom fibre, and grain, for pig and poultry feed.

Mangolds—for summer feed for dairy cattle.
Pumpkins, Squashes, Grammas, Pie Melons—sow in odd corners and in special plots.
Pea-nuts—for pig and poultry food.
Cowpeas—for fodder and pigs (grazing), also for mixing with maize in silage, and for hay. Useful to renovate soil of worn-out maize paddocks.
Buckwheat—for green fodder, and for grain for poultry and pigs.
Sunflowers—sow in odd corners and around sunny edges of maize crops, &c., for poultry feed and for mixing with cattle rations.

Vegetables—sow all kinds of beans, beets, lettuce, tomatoes, cucumbers, and melons.

Get land ready for further sowings of maize, sorghums, millets, and cowpeas.

North Coast—Clarence-Macleay Section.

Crops to sow—
Maize—sow largely for grain.
Sorghum—for green fodder and grain.
Millets—for green fodder, hay, brooms, and grain, for pig and poultry feed.
Mangolds—for pig feed.
Pumpkins, Squashes, Grammas, and Pie Melons—sow apart in special plots.
Cowpeas—sow for fodder and pig food and grain.
Buckwheat—sow for grain for poultry and pigs.
Sunflowers—sow for grain for poultry and pigs.
Teosinte—sow in drills 4 feet apart, 2 lb. seed per acre, for fodder or silage.
Kaffir Corn—for pig and poultry feed.
Milo Maize do do
Lucerne may be sown if season be favourable.

Vegetables—sow French and butter beans, leek, spinach, cucumber, egg plant, celery, capsicum, rhubarb, melons, and tomatoes; small sowing of peas, turnips, beet, lettuce, radish, carrot, parsnip, swedes, and rock melon may be made now.

Hawkesbury-Nepean.

Crops to sow—
Maize—sow for green feed and ensilage in rows 3 to 4 feet apart, and every 12 inches in row. Hickory King, Early Mastodon, and Iowa Silver-mine give great bulk of fodder with short season of growth. For grain, plant in drills 4 feet 6 inches apart, and either three seeds every 3 feet, if sown by hand, or one every 16 or 18 inches, if sown by dropper. Satisfactory yielders in this district are Red Hogan, King's Early, Golden Beauty, Pride of the North, and Early Leaming among the yellow, and Hickory King and Iowa Silver-mine among the whites.
Sorghum—sow for green fodder and seed for poultry or pigs Early Amber Cane and Planter's Friend are good varieties, the former is earlier and gives two and even three cuts per season.
Broom Millet—sow in drills 3 or 3½ feet apart, about 5 to 6 lb. per acre; thin out later to 4 inches apart in the drills. White Italian is the best.
Millet—for green fodder, hay, and grain, for pig and poultry feed.
Pumpkins, squashes, grammas, water and pie-melons—main crop may be sown.
Pea-nuts—sow for pig and poultry feed in light friable soil.
Cowpeas—sow for green feed either alone or in conjunction with maize, sorghum, or millet; makes good hay, especially the upright varieties. Suitable also as a green manure. Black, Upright, Whip-poor-Will, Clay-coloured, New Era, and Poona are all good varieties. Sow in drills 3 feet apart and 6 or 8 inches in the rows.
Lima beans and Soy beans are also worth a trial.
Buckwheat—sow for green feed and for grain for pigs and poultry.
Sunflowers—the Giant Russian is suitable for poultry feed and mixes well with other crops for ensilage. Sow in rows 3 feet apart.
Lucerne—main spring sowing can be made.
Potatoes may still be planted.
Jerusalem Artichokes—for domestic use and pig feed may be planted in odd rich corners; they are difficult to eradicate, and should not be planted where it is not possible to get the land thoroughly cleaned by pigs or by hand.

Shade trees and hedges—if not planted out in autumn may be put in now.

Vegetables — plant out sweet potatoes, chokos, and tomatoes; sow French and other beans, red and silver beet, carrot (main summer crop), cucumbers, vegetable-marrows, squashes, water and rock melons, leeks, lettuce, and capsicums.

South Coast.

Crops to sow—
Sorghum—sow a little for green fodder.
Maize— do do
Millet—French and Hungarian, former for hay, latter for green fodder.
Mangolds and Sugar Beet—for summer feed for dairy cattle.

Potatoes and Artichokes may be planted largely.

Pumpkins—Cattle—if danger of frost is over, sow early, if not, keep back until end of the month.

Grammas—	do	do
Melons—Pie—	do	do
Squashes—	do	do
Cowpeas—	do	do

Buckwheat—sow largely for grain for pigs and fowls.

Sunflowers—sow largely. The heads enrich silage if added to maize or sorghum

Lucerne—sow early in well-prepared land.

Grasses—sow all kinds of pasture grasses.

Vegetables— asparagus, arrowroot, beans, (kidney or French), Lima, beet, cabbage, cauliflower, celery, cucumber, endive, leek, lettuce, melons (rock and water), okia, onions, parsnips, peas, pepper, pumpkins, rhubarb, tomato, turnips, vegetable-marrow, and squashes may be planted as largely as desired this month.

Get land ready for maize and sorghum main crop.

Northern Tableland.

Crops to sow—

Oats—although late in most districts, oats may still be sown in New England for hay. Algerian is one of the best sorts for sowing late, as it comes on quickly. It is a fine, sweet hay variety, not so liable to rust in the late season as Potato oats, and others like them. When sowing late always sow more thickly; so late as this month, sow about 2½ bushels to the acre for hay, as heavy seeding prevents too much stooling, and the plants mature earlier. Half a cwt. of superphosphate to the acre will be found of benefit where the soil is not very rich, and will help greatly towards quick maturity.

Vegetables—potatoes—make small sowings of early varieties, such as Ashleaf Kidney, Cambridge Kidney, Royalty, and other potatoes of the kidney variety. Use formalin for the prevention of scab, as follows:—1 oz. (liquid) commercial formalin to 2 gallons of cold water; soak for about two hours, then cut and plant in the usual way. A sprinkling of fine ashes is good to prevent moisture escaping from the cut tubers. Plant large well-shaped tubers. Do not sow in land that has produced scabby potatoes last year or the year before. Sow cabbages, cauliflower, peas, beans, white turnips, &c., and get ready for pumpkins, melons, &c.

Get land ready for planting maize in the beginning of October. The soil should be deeply ploughed and well worked to get the best results. Also get ready for sorghums, millets, &c. A small sowing of these might be made to the end of the month; also sugar beets and mangolds.

Tableland—Bathurst Section.

Crops to sow—

Potatoes—for early crop may be planted about the middle of the month. These should appear above ground early in October, when danger from frost is slight. Upon the lower lands planting should be delayed from one week to a fortnight. Maize may be sown upon the highlands during last week of the month. It is too early to sow the low-lying lands.

Jerusalem Artichokes may be planted about the middle of the month. Sow mangolds, beet, carrots, lucerne, kale, kohl-rabi, grasses, sheep's burnet, and tobacco. Cereal crops under 1 foot in height could be harrowed to advantage.

Harvesting machinery should be overhauled and repaired if necessary.

Vegetables—Asparagus roots should be set out early in the month. Potatoes for early crop may be planted about middle of month. Sow carrots, parsnips, turnips, kohl-rabi, beet, cabbage, lettuce, early cauliflower, Brussels sprouts, tomatoes, capsicum, egg plant, radish, mustard, and cress. Transplant upon highlands a few tomatoes, cape gooseberries, capsicums, and egg plants. Small sowings of pumpkins, squashes, sweet corn may be made upon the highlands at end of month.

Central-western Slope.

Crops to sow—

Potatoes—plant early in month.

Maize—towards the end of month for green feed and silage.

Millets—	do	do
Sorghum—	do	do

Cowpeas—for green feed and grazing.

Vegetables—Transplant tomatoes and shelter from frost at night.

Cultivation—continue fallowing the land for autumn crops.

Machinery—overhaul and put in thorough working order reapers and binders and other machinery required for harvest; order bolts or duplicates that are likely to be required. If not already on hand, order oil, binder twine, sacks or other supplies necessary for the harvest. See that fire carts, beaters,

and other equipment for fighting bush fires are in good order, and in readiness for a sudden call.

Riverina.

Crops to sow—
Potatoes—planting should be completed.
Pumpkins and Squashes—sow and protect seedlings from frost.
Melons and Cucumbers—sow and protect seedlings from frost.
Sorghum—sow for green feed and silage.
Maize— do do
Millets— do do

Vegetables—in localities not very subject to frost and later hot winds sow beans of all kinds (except broad). Transplant tomatoes, and shelter from frosts with a few twigs of pine.

Get land ready for main sowings of sorghum, maize, and millets, including broom millet for heads and seed. Plough land to lie fallow for autumn sowing of cereals.

North-western Plains.

Crops to sow—
Lucerne, grass, maize, millet, pumpkins, sorghum, cowpeas, potatoes.

Get land ready for cropping in December with maize, sorghum, cowpeas, for silage and green fodder.

OCTOBER.

North Coast—Richmond-Tweed Section.

Crops to sow—
Maize, Sorghum, and Millet—for green fodder, silage, or grain.
Sugar cane—for fodder.
Pumpkins—sow extensively for cattle and pigs.
Sweet Potato—set out cuttings.

Vegetables—sow French beans, scarlet runners, snake beans, Lima, butter, and any other beans; plant out leeks and tomatoes, and sow seeds of squashes, marrows, and melons of all kinds.

Get land ready for later sowings of maize and sorghum for silage.

North Coast—Clarence-Macleay Section.

Crops to sow—
Maize—for fodder and grain.
Sorghum— do
Millets— do
Mauritius Bean, Florida Velvet Bean, or Soja—for green manuring and fodder.
Teosinte—for fodder or silage.
Indian Cane—plant cuttings 5 feet apart for fodder.
Cowpeas—for fodder, grain, or green manuring.
Sunflower—for poultry.
Pumpkins—sow largely for cattle and pig feed.
Sweet Potatoes—plant out shoots.

Vegetables—sow all kinds (beans, cucumber, water and rock melons, celery); plant out tomatoes and leeks; make small sowing (peas, cabbage, radish, lettuce, carrot, parsnip, spinach, beet red and silver, and onions).

Hawkesbury-Nepean.

Crops to sow—
Maize—sowing of main crop to be continued. In many localities the October sown crops will do better than September sown ones, owing to growth being unchecked by cold weather.
Sorghum—continue sowing for green fodder, ensilage, and grain.
Broom Millet—sow without delay.
Cowpeas, Soy Beans—further sowings may be made.
Pumpkins, Melons—sow as largely as desired.
Sweet Potatoes—set out cuttings or "rooted plants" in rows 3 feet apart and 2 feet in rows. Pink and White Maltese are both satisfactory; warm, sandy situations suit these best.
Lucerne—final sowings may be made early in the month.

Vegetables—sow French and all other kinds of beans (except broad), red and silver beet, carrot, cucumbers, marrows, melons, leeks, onions, lettuce; plant out tomatoes.

South Coast.

Crops to sow—
Maize—sow extensively for grain.
Maize and Cowpeas—sow for green fodder and silage; also for pigs.
Sorghum and Cowpeas—sow for green fodder and silage; also for pigs.
Millet, Hungarian—sow for green fodder and silage; also for pigs.
Pumpkins, Cattle—for stock and pigs.
Melons, Rock and Water—for market and domestic use.
Mangolds and Sugar Beets—for pigs and cattle.
Sweet Potato—for home use and pigs.
Lucerne—late sowing may be made if season favourable.
Sheep's Burnet—resists drought, and should be tried in pastures.
Cowpeas and Field Peas—extensively for green fodder, and to renovate worn soils.
Grasses—Paspalum dilatatum, Rhodes grass.

Vegetables—sow a few seeds of all kinds as advised for September to keep up supply.

Get land ready for further sowings for fodder. Every opportunity should be taken to provide winter fodder by means of ensilage of maize, sorghums, and other crops that can be grown at this time of the year.

Northern Tableland.

Crops to sow—

Maize—may now be planted, this being the best month generally for New England. Only early-maturing varieties have much chance of ripening properly in our short season. If sown after the plough in land inclined to be wet, plant seed half-way up the furrow slice instead of at the very bottom of the furrow; if heavy rain occurs after planting, much seed is rotted lying in the bottom, especially in stiff clay land. The young plant can root more easily and go downwards, if it has some loose earth underneath it.

Varieties that have done well here are Iowa Silvermine, Pride of the North, Riley's Favourite.

Millets—for hay. Hungarian and New Siberian are two of the best, and White Italian for broom-making; all do well here.

Sorghums—Amber Cane and Planters' Friend, two excellent sorts for green feed and ensilage.

Cowpeas—Black cowpea does the best in this district.

Field Peas—Partridge and Suntop are two good varieties.

Potatoes—whole potatoes for planting are generally advised in preference to cut sets. Scabby potatoes should not be planted, and land that has produced scabby potatoes last year should on no account be sown with potatoes this year, but either spelled or used for some other crop. From three years' trials, I have found the following potatoes all round to be the best for this district, viz.:—Brownell's Beauty, Satisfaction, Irish Flounder, Cambridge Kidney, and Manhattan.

Vegetables—

Frosts should now be over, therefore a number of vegetables may be planted —such as melons, pumpkins, squashes, beans, cucumbers, &c.

Preserving Melons—Triamble and Citron are amongst the best, and are good keepers, especially the latter.

Squashes—the Hubbard squash for keeping through the winter and for genuine eating qualities is hard to beat, and does well in this district. Other squashes that are much fancied here are the Long Fish and Custard varieties. Both grow well under favourable weather conditions.

Pumpkins—Crown, Silver, Nugget, and Ironbark are all eating sorts and good keepers: Crown and Ironbark especially so.

Cabbages may still be planted, also carrots and parsnips.

Asparagus—raising from seed is very slow, and it is recommended putting in plants 1 or 2 years' old.

Celery and White Turnips may also be planted. French beans and all varieties susceptible to frosts may be sown. To grow vegetables successfully, soil must be worked deeply, manured plentifully, and surface kept well worked to check weeds and conserve moisture. Water must be used in dry weather for most garden vegetables.

Tableland—Bathurst Section.

Crops to sow—

This is one of the busiest months, and is the best for planting maize, sorghums, millets, cowpeas, pumpkins, melons, sunflowers, and buckwheat.

Sow mangolds, beet, carrots, Jerusalem artichokes, kale, and kohl-rabi, and transplant tobacco into field about middle of month upon lowlands ; it may be set out somewhat earlier upon the highlands.

Towards the end of the month the first cut of lucerne will be ready to make into silage, if so desired. Residues of winter-grazing crops should be ploughed under.

All harvesting machinery should be overhauled and repaired.

Sheep should be shorn towards end of month.

Vegetables—plant early potatoes. Sow for main crop pumpkins, melons, cucumbers, squashes, sweet corn, French, butter, and lima beans. Sow in seed beds, cabbage, lettuce, and kohl-rabi. Transplant cabbage, Brussels sprouts, lettuce, tomatoes, capsicum, egg plant, and Cape gooseberries. Sow cauliflowers for main crop.

Central-western Slope.

Crops to sow—

Sorghum, Maize, Cowpeas, and Millet—main sowings for green stuff and silage.

Vegetables—plant French beans and melons. Transplant sweet-potato "plants" from cold frame or seed bed.

Machinery—If the strippers and cleaners have not already been attended to, put them in thorough working order.

Make provision to safe-guard the standing crops to be left for grain against fire by cutting strips for hay around and through them.

Riverina.

Crops to sow—

Rhodes and Mitchell Grass—in prepared land.

Sorghum—sow without delay.

Maize—for green fodder and ensilage.

Cowpea—for green fodder, hay, ensilage, or green manure.

Millet—for green stuff and hay.

Pumpkins and Squashes—sow without delay.

Melons and Cucumbers—sow without delay.

Get land ready to lie fallow for autumn sowing of cereals.

North-western Plains.

Crops to sow—

Maize, millet, sorghum, cowpeas, and pumpkins.

Vegetables—same as September.

Other work—thoroughly overhaul, clean, and oil all harvesting machinery, and see that you have plenty of spare parts, binder twine, &c.

NOVEMBER.

North Coast—Richmond-Tweed section.

Crops to sow—

Sorghum—sow on any land that is not required for other purposes.

Broom millet—sow a small patch so as to have the crop ripening in succession, which will permit of more time for harvesting.

Maize—sow for green fodder and ensilage.

Pumpkins and Melons—sow a good patch for storage.

Grammas—sow for storage.

Vegetables—sow full crop French, butter, and Lima beans; small sowing of cucumbers, squashes, and tomatoes.

Get land ready for late maize and sorghum.

North Coast—Clarence-Macleay Section.

Crops to sow—

Sorghum—for fodder and grain.

Maize—sow for grain, fodder, and ensilage.

Pumpkins, Grammas, and Melons—sow largely for storage.

Indian Cane—for fodder.

Mauritius Bean—for fodder, green manuring, and pulse.

Florida Velvet Bean—for fodder, green manuring, and pulse.

Soja Bean— do do

Cowpeas—sow largely for fodder and green manure.

Vegetables—transplant cabbage and tomatoes; French beans, butter beans, Lima beans, cucumber, and melons.

Hawkesbury-Nepean.

Crops to sow—

Maize—may still be sown according to weather conditions.

Sorghum and Millets— do do

Cowpeas, Soy Beans may be sown on land used for cereals, cut as green feed or hay.

Vegetables—sow all kinds of beans (except broad), red and silver beet, pumpkins, vegetable marrows; set out further cuttings of sweet potatoes and tomatoes; sow lettuce seed in permanent bed and thin out.

The cultivator should be kept going between the rows of growing crops to conserve moisture. In the case of maize, care should be taken to gradually decrease the depth at which the tines run as the roots near the surface may be injured.

South Coast.

Crops to sow—

Maize—late crop for grain.

Maize and Cowpeas—for fodder and silage.

Sorghum and Cowpeas— do

Millets—Hungarian for fodder.

Pumpkins and Melons—for market and fodder.

Artichokes—for pigs.

Potatoes—for domestic use.

Sweet Potatoes—for domestic use and pigs.

Cowpeas—largely for green fodder and silage.

Soy Bean—largely for fodder.

Mangolds and Sugar Beet—for fodder.

Get land ready for further sowing green fodder in order to keep up supply.

Vegetables—beans (French), Lima, butter, snake, and scarlet runners; beet (red and silver); cabbage, cauliflower, carrots, cucumber, leek, lettuce, melons, okra, onions, parsnips, peas, potatoes, pumpkins, rhubarb, tomatoes, turnip, vegetable marrow, and squash.

Northern Tableland.

Crops to sow—

Potatoes—main crop.

Maize—early-maturing varieties, such as Iowa Silvermine, Pride of the North, King Phillip (ninety-day), and Cinquatina (chicken maize) may still be planted. Sow only the best seed from specially selected cobs, if possible chosen in the field. Maize for silage may be sown this month, Hickory King and Early Leaming being two good varieties.

Sorghums—Amber Cane and Planters' Friend may be sown for cutting for cattle or for ensilage; both are much relished by stock.

Millets—of all kinds may be sown. Hungarian and New Siberian are good hay

varieties. Pearl millet stools well, and produces an abundance of green feed. White Italian is the best for broom-making.

Pumpkins, Cowpeas, Beans, and Squashes may be sown still; but it is getting late.

Cultivate all spring crops above ground to prevent growth of weeds and check evaporation.

Tableland—Bathurst Section.

Crops to sow—

Sow maize, sorghums, millets, cowpeas, pumpkins, melons, potatoes, sunflowers, and buckwheat.

All harvesting machinery should be overhauled and got into thorough repair.

The first growth lucerne should be ready to cut for hay by the beginning of the month.

The residues from rape and other crops should be turned under as quickly as possible.

Vegetables—sow pumpkins, melons, cucumbers, squashes, sweet corn, potatoes, beet, and French, Lima, and butter beans. Sow in seed-beds cauliflowers, cabbage, and Brussels sprouts. Transplant cabbage, lettuce, kohl-rabi, Brussels sprouts, and tomatoes.

Central-western Slope.

Crops to sow—

Maize—for green stuff and ensilage.
Sorghum— do
Cowpeas—for grazing and greenstuff.

Vegetables—plant French beans, marrows, squashes, and pumpkins; transplant sweet potatoes.

Cultivation—as opportunity occurs cultivate the growing crops that are in drills; feed off and harrow the fallows.

Riverina.

Crops to sow—

There are few crops, except sorghum, maize, and millets for green feed, that can be safely sown this month, and these only where irrigation is possible. Generally the whole of the resources of the farm will be concentrated on the grain harvest and the haymaking, which should be commenced while the wheat is in flower.

Oats should be allowed to stand until the tops of the heads are turning white.

All drilled crops should receive attention in the way of cultivation of the soil to retain moisture.

North-western District.

Crops to sow—

Maize, Pumpkins, and Sorghum—if they can be irrigated.

The conditions at this time of year are extremely trying for crops under dry cultivation.

DECEMBER.

North Coast—Richmond-Tweed Section.

Crops to sow—

Maize—sow for green fodder and ensilage.
Sorghum—sow for green fodder and ensilage.
Broom Millet—sow for broom and seed.
Sweet Potatoes—set out as large an area as possible for domestic use and stock fodder in winter.
Paspalum—sow seed and plant out rootlings.

Vegetables—French bean is about the only vegetable that can be safely sown this month.

Get land ready for further sowings of winter fodder crops.

North Coast—Clarence-Macleay Section.

Crops to sow—

Maize, Sorghum—largely for grain, fodder, and silage.
Kaffir Corn—for grain for pigs and poultry.
Broom millet—sow for fibre and seed.
Sweet Potatoes—plant largely for winter pig feed.
Indian Cane—sets may still be planted.
Cowpeas—for fodder and grain.

Vegetables—sow French beans, cucumber, squashes, and marrows. For pumpkin beetle, dust lime on plants through a sugar-bag, thus getting a fine shower.

Hawkesbury-Nepean.

Crops to sow—

Maize, Sorghum, Millets—for green fodder, ensilage, and grain.

Cowpeas may be sown for pig feed or green manure, but may not mature seed where early frosts are common.

Vegetables—sow beans of all kinds (except broad), celery (under shade), pumpkins, cucumbers, bush marrows, &c.; set out in seed-bed cabbage and cauliflower.

Get land ready for autumn crops of potato, turnips, rape.

South Coast.

Crops to sow—

Maize and Cowpeas, Sorghum and Cowpeas—for green fodder and pigs, also for silage.
Millet—for green fodder.
Cowpeas and Soy Bean—for green fodder and pigs.
Sweet Potatoes—for pigs.
Mangolds and Turnips—for fodder.
Rape—for grazing.

Get land ready for late sowings of fodder.

Vegetables—sow a few seeds to keep up supply. Cabbage, cauliflower, celery, egg-plant, maize, sugar or sweet onions, parsley, radish, spinach, turnip.

Northern Tableland.

Crops to sow—

Sorghums may be sown for green fodder and for silage. The two best varieties for this district are Early Amber Cane and Planters' Friend; the latter is a great favourite with dairymen, though here Amber Cane has been the larger cropper. Sorghum, if drilled, may be sown at the rate of 8 lb. or 9 lb. per acre; if broadcast, about 14 lb. will, generally speaking, prove ample.

If the crop is to be fed straight to the cattle they do not waste so much if the stalks are fine, so it is advisable to sow thicker in this connection than if the crop is intended for the silo.

Millets may be sown for hay and for green fodder. Hungarian and New Siberian are both good hay sorts. Pearl Millet stools well and yields an abundance of green feed.

Do not allow cattle to feed on the young growth of sorghums, either on first or second growths, as at both stages they have proved on many occasions fatal to stock; probably this is through an excess of prussic acid in the young plant. When once the plant comes into head, however, it may be fed freely without the slightest danger.

Potatoes may still be planted for the main crop. Centennial, Irish Flounder, Manhattan, and Brownell's Beauty have all done well here, and are good keepers.

Good-sized seed free from blemishes should always be used; never sow too small, nor ill-shaped, seed; see also that no disease is present.

Oats may be fit to harvest this month, Generally when the tops begin to turn white it is fit to cut; let the grain form somewhat in oats, but not in wheat; cut the latter when in flower. The grain of wheat is not very digestible in its raw state, and it is far better to have all the nutriment distributed in the straw, which will be sweeter, more digestible, and a better marketable colour.

Pumpkins may still be sown in New England, though it is getting late. Grammas are good feed for stock, and grow well under ordinary cultivation.

Crown, Ironbark, and Hubbard Squashes are all good table varieties and fine keepers. Be sure and keep down weeds, and it is as well to plant so that the cultivator may be freely used in the first stages of growth.

All summer crops, where practicable, should receive frequent shallow cultivation.

Tableland—Bathurst Section.

Crops to sow—

Plant potatoes for main late crop. Sow maize and sorghums for green fodder. Pumpkins and melons may still be sown at the beginning of month. Make a small sowing of Swedes towards end of month.

This is one of the busiest months as harvesting of wheats, oats, barleys, and ryes will be in full swing.

Maize and other summer crops will need cultivating.

If practicable land from which hay was gathered could be ploughed. This may be fitted in during damp weather.

Vegetables—plant potatoes for main crop Sow French and butter beans. Sow cabbage, turnips, Brussels sprouts, celery, squashes, cucumbers, and sweet corn. Transplant cauliflowers and cabbages.

Whenever practicable, all land for main farm crops should be ploughed three to four months before seed time, to be again ploughed and sown upon a fresh furrow.

A system of crop rotation should be followed.

Central-western Slope.

Crops to sow—

Maize (early varieties), Sorghum—for green stuff and silage.

Cowpea—for grazing and greenstuff.

Vegetables—plant French beans, marrows, squashes, pumpkins; set out sweet-potato plants.

Cultivation—As opportunity offers during this busy harvest month continue the cultivation of growing crops and to feed off, and after rain to harrow the fallows.

Riverina District.

Crops to sow—

Maize, Sorghum, Millet—sow for ensilage and green fodder only where irrigation is possible.

All growing crops should be cultivated frequently.

Vegetables—

Stake tomatoes, and mulch after watering.

Get land ready, if at all in suitable condition, for early autumn sowing.

North-western Plains.

Crops to sow—

Maize and Pumpkins—if they can be irrigated.

Vegetables—nil.

Other work—commence to plough land for autumn sowing, plough in all the stubble that you can, especially on the black soil.

Orchard Notes.

W. J. ALLEN.

SEPTEMBER.

Codling Moth.

SEE that all rough bark has been well cleaned from off the trunks and limbs of all apple and pear trees, and all grubs found thereunder destroyed, and the rubbish taken from the trees promptly burnt, in order to destroy any grubs that may have been overlooked. Make early preparations for fighting this pest this coming season by ordering a stock of arsenate of lead, of which Swift's is (as far as I can find out) the best on the market at present. Make any fasteners which may be required for securing bandages to trunks of trees; see that the spray pumps are in thorough working order, so that when the time arrives for beginning to fight this pest, there will be no delay, and make up your minds that should this pest show itself, it will have a bad time from the first day of its appearance until the end of the season; and if you find your neighbours are not doing the same. report them, as to keep the moth in check every grower of apples, pears, and quinces must join in the fight. The correct stage at which to spray is shown in illustration on cover of this issue.

Green Manures.

These should be turned under as early as possible this month, if the work has not already been completed. If the crop is heavy, the disc cultivator

Turning under rye crop for green manure at Bathurst Experiment Orchard.

Showing how a chain is adjusted to help cover in the mass of green-stuff.

may be run over it once or twice before it is ploughed under. This will cut the crop up a little, and facilitate the work of turning under. Single furrow ploughs, with chains, are usually the best for this work.

How the chain operates.

Loosening Soil around Trees and Vines.

All soil should be loosened with either a fork hoe or a spading fork, and all couch grass, sorrell, or other weeds removed and burnt. This work should be carried out in the early spring, while the soil is moist and easy to work.

Fruit Fly.

It is pleasing to know that this pest, which created quite a scare among the growers some two years ago, has almost ceased to do them any damage. Towards the fall, a few of the Mediterranean flies were found in isolated places, but with the strict attention required under the Act, and the careful attention given by the majority of the growers, few of the larvæ of the fruit fly escape the boiling down or burning processes.

Red Oil Emulsion and Woolly Aphis.

This is an exceptionally valuable spray, as, not only will it destroy woolly aphis, but mussell and other scales as well. For the woolly aphis, 1 gallon of red oil to 30 or 40 gallons of water will destroy the aphis.

Whilst visiting Wallangarra, at the end of August, I saw an orchard which had been sprayed with a mixture of 1 gallon of oil to 90 of water, and most of the aphides were destroyed. I think, though, the stronger sprays are required to destroy San José Scale and the Red Mite, but there is the danger, I fear, that the bark of trees sprayed with a strong solution will—in our warmer climates—suffer from sun scald if the tree is at all open, and the bark is much exposed during summer months to the sun's rays. I would, therefore, recommend growers to experiment a little for themselves with this spray, to find out the least quantity of oil required to mix with from 30 to 50 gallons of water, for the destruction of Woolly Aphis, Red Mite, Mussell, and San José scales.

If the spring proves to be a wet one, it is advisable to spray any trees which have in previous years shown signs of fungus diseases, such as Peach Curl of the peach tree, Black Spot or Scab of the apple, Black Spot of the grape vine, and growers of Gordo Blanco and Sultana Vines will have to keep a sharp look-out, and the spray pumps going, else the crops will be lost.

Bordeaux Mixture will be found the best spray at this time of the year for all fungus diseases. Should the San José Scale put in an appearance after the leaves have started on the tree, the resin, soda, and fish oil wash will be found the best to use at this season of the year.

Never spray either trees or vines while they are in bloom, or the chances are the crop will be destroyed. They may be sprayed a week before coming into bloom, and a week after the fruit is set.

Although it is very late for planting deciduous trees, yet they may be planted if they have not yet began to shoot. They should receive special

care and should be well cut back. If the ground is at all dry, they should be given one or two bucketfuls of water after planting.

Pruning.

In some districts pruning may not have been completed by the beginning of this month. The following illustrations show a good method of pruning a young peach-tree that has made too much growth.

Before pruning.

After pruning.

Apples from the Bathurst Experiment Farm.

At the beginning of April a consignment of Rome Beauty and Cleopatra apples from the Bathurst Experiment Farm was forwarded to Vancouver by the Department of Agriculture.

A report has now been received indicating that the fruit arrived in excellent condition, having been well graded and well packed. The shipment sold rapidly, and the price obtained, 11s. 4d. per case, was the highest realised up to the time of sale. After allowing for all expenses the net return was approximately 7s. per case, which may be considered a very satisfactory price.

It might be mentioned that the net return per case from the 400 cases of Jonathan and Cleopatras from the same Farm, which were sent to London for sale in March last, was practically the same, viz., 7s.

Australian Apples in German Markets.

During the last season Australian apples realised very satisfactory prices in Germany. The trade is principally in South Australian fruit, and limited.

Mr. M. G. B. Jefferson, of Sussex-street, Sydney, has been good enough to submit particulars of the auction sale at Hamburg, on 1st May last, of 4,270 cases of Australian apples and 13 crates of Australian pears.

All the fruit was sold under the grower's or packer's original marks, and the name of each variety was indicated on the case with the grading. In the catalogue submitted to bidders there were shown all these particulars, and, in addition, the diameter of the fruit graded.

Eight cases of Dunn's Seedling, grade A, fetched 18s. each; 30 cases of Cleopatra, grade special, fetched 17s. 9d. each; 23 cases Jonathan ($2\frac{1}{2}$ inches diameter) were sold at 17s. 6d. each, and there were many lots disposed of at prices ranging from 17s. per case to 6s. 6d. for some third grade Munroe's ($2\frac{1}{2}$ inch) and third grade Five-crowns. The bulk of the 4,270 cases realised well over 12s. per case for the superior grades and to 10s. for third grade. The pears sold well, and there was only one lot damaged. It might be mentioned, in passing, that the South Australian shippers are generally pretty successful with their pears. The writer has seen quite a large number of South Australian pears on the English market in splendid condition. In the present instance Winter Cole pears fetched 15s. and Vicar of W. 14s. 6d.

It cannot be denied that the average shipments of South Australian apples and pears are of a very attractive character, but our fruit is quite as good, and it has already been demonstrated that, at the Bathurst orchard at all events, the art of packing is practised to the perfect satisfaction of the British buyer.

Wood Ashes for Fumagine (Smut) on Citrus Trees.

Mr. Inspector Smith reports that a mixture of 1 bucket of wood ashes and 3 buckets water sprayed over smutty citrus trees will help to clean the wood and foliage.

When trees get thoroughly covered with smut it is exceedingly hard to clean it off with anything, at least that is the experience of many growers. The samples of leaves submitted by Mr. Smith were not clean or anything like it, still the treatment is very cheap and very simple, and in the case of freshly infested trees would doubtless be of great benefit.

Fungicides for Citrus Trees.

Mr. Inspector Nicholson submits the following inquiry:—If Bordeaux mixture is to be used for melanose or other diseases of citrus trees and fruit, could soda be added without impairing the efficiency of the mixture? I find that a mixture (called, locally, Burgundy) is used by growers, viz.: 4 lb. bluestone, 6 lb. carbonate soda to 60 gallons of water. If lime were added to this mixture would it have any weakening effect on the bluestone and soda?

The question is asked because many growers are anxious to know whether one spraying could be performed instead of two sprayings for different diseases. The chemist, Mr. F. B. Guthrie, reports: "The addition of soda to Bordeaux mixture, or of lime to the bluestone and soda, would not reduce the efficiency of the copper, but the addition of soda would make the spray very caustic, a condition which is usually considered to be undesirable in Bordeaux mixture."

Diseases of Banana Plants.

In forwarding for examination and report specimens of a banana plant affected with disease, a Byron Bay correspondent says:—"About a year ago I noticed a clump of bananas in my plantation looking sickly, the leaves turned yellow, and finally all the stalks (young as well as mature) broke off near the ground. Now I notice the clumps adjacent are similarly affected, so I purpose uprooting them and carting all away, after which I will bring firewood and burn the ground where the affected plants are. Do you think this a good plan, or should some germ-destroying agent be applied, such as bluestone?

"Bananas do so remarkably well upon this north-east slope that it would be a pity to see them all fail, as I am informed they did upon the Clarence many years ago."

The writer adds in another communication that about $\frac{1}{8}$ of an acre of his plantation is affected.

The specimens were examined at the Bureau of Microbiology, and the following extracts from the report may be of interest:—

"The specimen received was a portion of the stock of an apparently well-grown tree. Externally it showed an irregular patch several square inches in area, discoloured, and softer to the touch than the surrounding tissue. On pressure fluid exuded through fissures. On cutting the stock (transverse and longtitudinal sections) the whole of the tissue was sodden, and much free fluid existed between the leaf sheaths as well as in the actual tissue. The sections of individual leaves showed areas of discolouration—grey, green, light brown, and dark brown, and the core was softened, and in parts diffluent: its ordinary fibrous character being replaced by one suggestive of a paste. From the appearances the mischief was apparently proceeding from below upwards, but this point is not settled by the specimens available. The diseased parts had a very foul odour.

"Microscopical examination of the fluid and of tissue from the diseased parts revealed the presence of:—

(a) grubs,
(b) mites,
(c) nematode worms,
(d) bacteria,
(e) a fungus.

"(a) The grubs comprised two kinds of dipterous larvæ. The first was a small white variety, and on being hatched out gave a tiny fly, which the Government Entomologist states is a member of the *Phoridæ* family. The other was a large brown grub, and on hatching gave a large fly, which the Government Entomologist has identified as *Neœxareta spinigera.*

"(b) The mites were in various stages of development, but apparently belonged to only one species.

"(c) The small white thread-like nematode worms were present in enormous numbers, actively moving about in the fluid.

"(d) By cultivation upon appropriate media there were isolated five species of bacteria and a mould fungus. The subsequent investigation of them yielded the following results:—

"Of the bacteria two were offensively putrefactive species, no doubt responsible for the foul odour; a third was a chromogenic species, which caused the green and red discolourations; a fourth grew upon banana (sterilised sections) apparently without producing injury; whilst the fifth discoloured and destroyed the banana in its growth.

"(e) The mould fungus proved to be a *Fusarium*, but its exact species so far has not been determined.

"A healthy banana stem examined at the same time for comparison was free from any parasites or invaders.

"Having ascertained the presence of these various beings, one is confronted with the problem of determining which, if any, of them is responsible for the disease, but after lengthy consideration of all the probable causes, the determination of the true cause of the disease remains in suspense. Interrogation of the matter will be pursued by examination of further specimens covering all stages of the disease, and by the inoculation experiment which it is proposed to make. This will necessarily involve the expenditure of time and patient energy. Meanwhile the observations which have been made lead to the suggestion that the disease in question is a wet 'rot' of bacterial origin—*a bacteriosis*; but in default of final settlement it is not feasible to base interim preventive measures upon this probability.

"The general welfare of the plantation is opposed to the idea of any toxic quality in the soil; and this fact, taken in conjunction with the statement that the disease spreads from tree to tree, indicates that the injurious agent is more likely to be biological than chemical. It would be well, therefore, to minutely search about the roots of affected plants for evidence of present or recent occupation of ground beetles or other burrowing animals which might have bitten the roots (though the nematode worms must not be forgotten in this connection). Measures against the presumptive bacterial cause are difficult of application. It is not thought that the soil could be efficiently treated with a chemical disinfectant. The uprooting and destruction by fire of all diseased plants, including the roots, would appear to be rational, and some advantage might be derived from burning the ground as suggested by our correspondent. It is advised further that the ground be afterwards well dug and broken up and spread, and turned over at short intervals, so that every part gets thoroughly exposed to air, and particularly to sunlight."

BACK NUMBERS OF THE "AGRICULTURAL GAZETTE."

THERE are in stock a number of parts of the *Agricultural Gazette* for the years 1906, 1907, and 1908. The parts are unbound and comprise all the issues for the years named, with the exception of No. 1 of 1906. Farmers desirous of obtaining any of these copies may do so on application to the Under Secretary, Department of Agriculture, Sydney, and on payment of the postage. It may be mentioned that postage on the complete parts for one year amounts to 1s. 9d., and on single numbers 2d. The parcels could be forwarded per railway. In this case stamps should be enclosed to cover cost of freight. Each part weighs just ½ lb., and the whole set for a year 6 lb.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1909.

Society.	Secretary.	Date.
Barmedman Ploughing Carnival and Horse Parade Society.	P. H. Sheahan	Sept. 1
Junee P., A., and H. Association	T. C. Humphrys	,, 1, 2
Lockhart A. and P. Society	H. Parnaby	,, 7, 8
Young P. and A. Association	G. S. Whiteman	,, 7, 8, 9
Cudal A. and P. Society	P. Gavin	,, 8
Ariah Park A., H., and I. Association	A. T. White	,, 8
Germanton P. and A. Society	James S. Stewart	,, 8, 9
Cootamundra A., P., H., and I. Association	W. E. Williams	,, 14, 15
Cowra P., A., and H. Association	J. T. Martin	,, 14, 15
Albury and Border P., A., and H. Society	W. I. Johnson	,, 14, 15, 16
Canowindra P., A., and H. Association	J. J. Finn	,, 21, 22
Moama A. and P. Association	J. C. Smith	,, 22
Burrowa P., A., and H. Association	W. Burns	,, 22, 23
Temora P., A., H., and I. Association	John Clark	,, 21, 22, 23
Henty P. and A. Society	P. H. Paech	,, 28, 29
Wyalong District P., A., H., and I. Association	Thos. A. Smith	,, 28, 29
Millthorpe A. and P. Association	C. H. Shepherd	,, 28, 29
Ganmain A. and P. Association	A. R. Bolton	,, 29
Northern Agricultural Association (Singleton)	F. A. Bennett	,, 29, 30, Oct. 1
Adelong P. and A. Association	A. W. Molineaux	Oct. 5, 6
Bathurst Spring Horse Show	A. H. Newsham	,, 6
Menindie P. and A. Association	L. E. Underdown	,, 13, 14
Carrathool P. and A. Society	H. McMahon	,, 20
Horticultural Society of N.S.W. (Sydney)	A. W. B. Bradley	,, 21
Lismore A. and I. Society	T. M. Hewitt	Nov. 17, 18, 19
Tweed and Brunswick A. Society	F. A. Wildash	,, 24, 25
Berry Agricultural Association	C. W. Osborne	Dec. 8, 9, 10

1910.

Society.	Secretary.	Date.
Albion Park A. and H. Society...	Hector G. Fraser	Jan. 19, 20
Kiama A. Association	R. Somerville	,, 26, 27
Wollongong A., H., and I. Association	F. W. Phillpotts	Feb. 3, 4, 5
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Irrigation in Italy.

CHARLES W. SMITH, M. INST. C.E.

IRRIGATION in Italy, according to ancient authorities, dates back to the days of the Cæsars; at all events, in the vast agricultural centres of Northern Italy, lying within the great basin between the Alps and the Apennines, the produce has been mainly grown by irrigation, for many generations. Lombardy in the twelfth century, and Piedmont in the fourteenth, made rapid strides in their irrigation development. Their works have been studied by eminent modern hydraulicians, especially Herisson, Baird Smith, and Scott Moncrieff, who have contributed most valuable literature on the subject, as also have Messrs. Alfred Deakin, Stuart Murray, and Elwood Mead, of Victoria.

It is to the northern portion of Italy, namely, that watered by the river Po and its many large confluents, that we must look for the most striking examples in every branch of irrigation science. It comprises the largest irrigated area; possesses the finest canal and distribution works; and sustains an enormous population. I therefore propose to describe somewhat fully the works, the mode of distribution, and the water policy obtaining in Lombardy and Piedmont, these two important provinces being practically the pioneers of European irrigation.

The Valley of the Po.

The enormous valley of the Po, which is 250 miles long, with an average width of from 60 to 70 miles, somewhat resembles the valley of the Nile, in that it has in the course of ages been reclaimed from the sea. It is bounded by the Alps on the north and west, and by the Apennines on the south. The soil is extremely fertile, and Nature has, by the lay of the land, facilitated the distribution of water. The flatness of the country is particularly evident to the engineer when he views the great lengths of the straight canals.

No storage works are necessary here, for the rivers which rise in the Alps are fed by melting glaciers and snow, a source of supply not likely to be exhausted.

The supply from the Apennines is much smaller and more irregular, 10 acres of land being irrigated on the north side of the Po for every 1 acre on the south side. Many engineering and other difficulties were met with in connection with the diversion of the water from the rivers to the canals. The wild rush of these mountain torrents, bringing with them tons of débris, had to be controlled, involving enormous outlay; but the expenditure has been spread over many centuries, and consequently not appreciably felt.

Many of these torrents are, however, received into a chain of lakes which lie among the hills, and the water from them is released in a clear and quiescent condition. As in Australia, the rivers within the basin have raised their beds above the surrounding plains, and while this greatly facilitates the distribution of water for irrigation purposes, levee or bank works are necessary for protection against floods, which, owing to the denudation of timber, progressively increased. On the river Po alone the embankments extend for 300 miles. This work was commenced in Etruscan times, continued by the Romans, and completed to the Adriatic Sea as early as the thirteenth century. The banks are variously protected, and the finished slopes planted with grass.

The climate of Northern Italy is variable; in Milan and Turin, the respective capitals of Lombardy and Piedmont, the thermometer reaches zero in winter, and 100 degrees Fahr. in summer. The difference between the average temperature of the hottest month in summer and the coldest in winter is about 80 degrees Fahr. The rainfall is something like our own in the neighbourhood of Sydney. Taking that of Milan, the average is about 40 inches; close to the Alps about 55 inches; while in some places on the Alpine slopes it reaches 90 inches. The centre portion of the valley averages from 30 to 40 inches, while south of the Po it falls at times below 25 inches. Northern Italy cannot therefore be considered an arid country, and the artificial watering of its crops must be greatly helped by so useful a rainfall.

Irrigation and Navigation.

Irrigation and navigation in Italy have in the early epochs always been hand in hand, and many of the large canals are still used for both purposes. Some of the canals date back to the twelfth century, when the chief works in Lombardy were constructed. The natural conditions of the basin of the river Po necessitated the earliest development of systematic treatment both for navigation and irrigation, and throughout the Middle Ages, up to the first half of the last century, this network of waterways afforded the easiest means of communication for commercial purposes.

Notwithstanding the extensive railway system now obtaining, water transit is still in favour.

The chief canal, Naviglio Grande, and its connections, nearly 80 miles in length, carries about 400,000 tons per annum. In fact, one-fourth of the whole traffic of the Kingdom of Italy is carried by water. The canals are also used for manufacturing purposes, and enormous volumes of water are supplied to mills and factories. The administration of so vast a system, involving such varied interests, must *per se* be highly efficient, as the results are everywhere admitted to be perfect.

Almost all the irrigation canals in Lombardy and Piedmont are the property of the State, though many of them were originally constructed by individual enterprise. Fortunately, the State ownership of water is firmly established in Australia, as will also be the head works and main distributaries, and therefore there is no necessity to enlarge upon the advantages

accruing from such a control. The Italian Legislature has acted throughout, in connection with these works, on the principle that the expense is chargeable to those benefited, in proportion to the value of their interests, whether to the State, the province, the municipality, or the individual.

Control of the Water.

The State proprietary of the water undoubtedly secures its equitable distribution, and its ownership of the head works is recognised throughout these provinces as the best means of ensuring justice to the irrigator. With regard to distributary works, the critics upon the Italian system are unanimous in their appreciation of the co-operative management by the irrigators.

Although the State has absolute control of most of the canals, it deals by preference with associations of consumers who purchase the water and arrange for its distribution among themselves. Some of the syndicates, or associations, deal with the complete canalisation of large areas, while others merely control a single lateral. There is scarcely a landowner who does not belong to one or more of these bodies for receiving and disposing of water, or for protection against floods.

Baird Smith says that "the administration is always best when the land proprietors themselves can be made its agents; and, when the association principle is in vigorous and healthy action, it is a far more powerful conservator than the most elaborate establishment depending solely on the Government, though supported by the most stringent edicts and proclamations."

Municipal bodies have at times helped to construct large irrigation works where the vital interests of their ratepayers is indirectly concerned. For instance, the Provincial Council of Milan aided by a bonus of £80,000 the construction of the Villoresi Canal, extending from the Ticino to the Adda, which is 100 miles in length. It has a capacity of 93,000 cubic feet per minute. By means of these works, a strip of land, which had fallen into desuetude, in consequence of the keen competition of the Indian and Chinese in the silk and maize markets, was brought under intense culture, and its prosperity was again assured.

Extent of Irrigation.

In Northern Italy there are upwards of 3,000,000 acres annually irrigated in the valley of the Po, a river which from its source to the sea is entirely within the Kingdom of Italy.

A description of this favoured district by Herisson is well worth quoting. He says: "The system of irrigation has nowhere else been carried out to such an extent. As we pass through the Milanese lowlands we can perceive the power of this organisation, and its effects. Almost every hundred yards we come upon either a canal or a drain; there is not a field but is bathed along at least two sides by clear and running water, brought sometimes a distance of over 100 miles. Fertilising streams intermingle with blocks of cultivated land, which are always beautiful, and even in the dead of winter we may see

the mowers cutting splendid crops of grass. This water, which gives to the summer the freshness of the rainy season, can also give to the winter the warmth of spring. The mind is overcome with wonder at what the intelligence and energy of the people have accomplished, especially when we consider that Lombardy has always been the battlefield of all Europe, and that it has been in the midst of the incessant ravages of war and the continual changes of Governments, that these prodigious works have been constructed."

This graphic description in no way exaggerates the beauty and fertility of the country, and the remarks are equally applicable to the whole of the area treated by irrigation. The rivers within these provinces have a flow of nearly 4,000,000 cubic feet per minute, and more than half this volume is diverted for irrigation by innumerable canals carrying from 9,000 up to 420,000 cubic feet per minute, or 70,000,000 tons of water spread over the land every day in which the canals are in full work.

Canals and Distribution Works.

To describe all the off-take works, the main canals, and the distribution works, in the limited space of an article such as this, is obviously impossible, and I will do no more than cull a few typical examples. In Lombardy, the Naviglio Grande is one of the largest canals; it belongs to the Government, and is used for navigation, irrigation, and power. The head works are situated at Tornavento, on the Ticino River, and distant about 31 miles from Milan. The diversion dam across the river is 918 feet in length, and from 31 to 58 feet in breadth. The greatest part of the structure is concrete, with timber piling and beams, and over this mass is placed a casing of cut stone closely fitted and dowelled. This dam has stood for over 200 years. The sides of the canal at the off-take are walled in heavy masonry, and the floor for some distance is paved with large blocks of granite.

On account of its use for navigation, the canal had no head-gates, and this made the regulation of the supply during floods a serious problem of the past.

To get rid of flood waters, there were constructed within the first 5 miles of the canal 185 openings or waste-ways. These arrangements, however, are now being altered, in order that the water-power may be fully utilised and the in-take properly controlled.

The sale of water for generating power will, it is estimated, exceed £20,000 a year, or at a charge of £6 to £8 per horse-power per annum.

The history of this canal, from a commercial standpoint, is a most instructive one. It was built without any well-defined regulations as to volume that each customer was to receive, and there was no system of measurement. Irrigators were permitted to use as much water as they pleased without restraint. Interests grew up which exercised rights really belonging to the Government. Water rights were given away in the most reckless manner for services rendered. Another abuse was the farming out of rentals, which sacrificed the irrigators, but put money in the pockets of

the vendors. The first systematic attempt at measurement was made in 1376. Seventy years later, the Duke of Milan annulled all water rights within his territory; but, as a revolution was threatened, the abrogation was limited to State rivers and canals; but the Naviglio Grande remained unaffected. In 1503 Louis XII of France controlled this canal, and adopted the idea of a Royal Commission to square up matters. After this a proper measurement of water was introduced, and apparently the grievances and abuses ceased.

Another important canal is the Villoresi, previously referred to, and named after an engineer who in 1850 began the survey of a route from Lake Maggiore. It was the revival of an old scheme propounded 600 years ago. Thirty years after the survey was begun, the Italian Society for Aqueducts contracted to build this canal on receipt of a bonus of £80,000 from Milan. The Villoresi Canal is one of the most complete irrigation works in the world. From the dam to the smallest measuring modules, work has been carried out in the most perfect manner. The restrictions placed by the Government on the constructors were many and important. The dam interrupted navigation, hence locks had to be provided; the automatic delivery of water to holders of prior rights had also to be met; and a private canal had to be supplied with 282 cubic feet per second. For its own use, the society built both a power and irrigation canal.

The diversion dam at the off-take, which is 15 miles below Lake Maggiore, is built of concrete faced with granite. It is 950 feet long, 78 feet wide, and 12 feet high, protected at the foot by a masonry floor extending 50 feet down stream. Masonry wing walls at both ends are provided. The controlling gates comprise a two-storey structure built of granite and brick. It is 220 feet long, 42 feet high, and 20 feet wide. There are thirty openings with gates 5 feet by 11 feet 6 inches, with sills 9 feet below the top of the dam.

It is to the engineer of this canal that we owe the Cippoletti Weir, which bears his name, and which has been in use here for some years.

With the Villoresi Canal I must couple that bearing the name of Count Cavour, which Herisson refers to as "being constructed with all the resources of modern science, and in a country where experience on works of this kind dates back 600 years."

Upon completion it passed into the hands of the State, and still remains the finest of its waterworks. It is, in a sense, the chief and typical canal of the country, and supplies the greatest extent of irrigation works. Its present length and proposed extensions amount to about 120 miles. It feeds 900 miles of secondary canals; it supplies half a million acres directly, and a very large area indirectly. It is a work that can be used for intercommunication with other canals derived from the Po, the Dora Baltea, and the Sesia. Its channel has a bed width of 66 feet.

At the off-take works, the river Po is a wide, shallow stream, but with a steady supply, and often carrying enormous floods.

The weir is 1,525 feet long, built of two rows of piles filled in with loose stones, and stretching in a curved line diagonally across the stream. It cost only £1,000, and was intended merely as a temporary structure to supply the canal until the permanent weir could be undertaken. But this rough and simply-designed work answered so well that it has been allowed to remain, and has done service for upwards of forty years. The regulating off-take to the canal, which has a width of 131 feet, is, on the other hand, a very handsome structure, and at its west end there is erected a beautiful statue to Count Cavour. The water is admitted into the canal through twenty-one openings 7 feet high by 4 feet wide. There are two sets of gates, one to the front and one at the back, the object being to facilitate manipulation in times of flood. Above these openings there is a second storey, with upstream wall in solid masonry, as a protection against floods, which attain a height of 26 feet. The third storey is used as a bridge for crossing the canal, and as a gallery for operating the gates, whose iron stems extend into the gallery. The other works along the course of this canal are equally massive and important. The river Dora Baltea is crossed by a nine-arched masonry aqueduct 635 feet long, with embankments extending over 7,000 feet. The canal is carried under the Sesia by a siphon 820 feet in length, composed of five oval tubes 16.4 feet by 7.54 feet. The Elvo is crossed by a siphon 582 feet long. All the watercourses crossed can be used as flood escapes in case of accident. Altogether there are 109 bridges, 61 aqueducts, and 252 siphons in the 52 miles of main channel, which also crosses some thousands of private irrigation ditches. All kinds of obstacles were met with, but all were overcome in a masterly manner; in fact, throughout its entire length, this work is a lasting monument of engineering skill. The cost of the canal itself, including the connections with the older canals, may be set down at over £3,000,000. The Cavour Canal, with its connections, rights, and privileges, was sold to the Government in 1874 for £4,000,000.

There is no object in describing in detail the distributary and secondary channels and modes of measurement obtaining, but a brief account of the manner in which the water is applied by the landholders after it leaves the laterals may be interesting.

Methods of Irrigating.

The methods and appliances are of the simplest. Flooding is generally practised. A ditch is carried along the higher side of a field, and dammed either by a simple iron gate, or by a few sods of turf. The water then overflows the sides and spreads in a thin stream across the field, until it reaches a drain, which receives the surplus and delivers it into another irrigating ditch above a lower field, and so on. This water is sometimes used seven or eight times by the same, or different proprietors. Most of the channels are made with a plough or spade, as also are the checks, or plots, into which the fields are divided. The size of these checks is, of course,

determined by levels; this is done to ensure an even distribution of water over the whole land. An enormous amount of work has been accomplished to secure even surfaces commanded by each ditch.

Cost of Irrigating.

The breaking up of new ground to prepare for watering often costs £5 per acre; and for marcite, a mixture of clover and Italian rye-grass, which requires special preparation, the cost is from £10 to £40 per acre. These marcite meadows are divided up into small "lands," as they are called in England, with ridge and ditch on each side to secure drainage.

The prices charged for water throughout are not based on a system one could recommend for adoption here. The extravagant and objectionable custom of selling water according to the area and crops thereon, and leaving the volume to be determined by the irrigator's judgment, has nothing to commend it.

An acre of maize under this system would cost 5s., meadow land 19s., marcite 20s., and rice 33s. per season.

When water is sold by measure, the year is divided into two periods, summer and winter. The price per cubic foot per minute in the summer season is 9s. on the Cavour, and 13s. 4d. on the Villoresi. On some of the older schemes the prices are lower, but it is difficult to determine their relative value, as they are so hampered with old customs and rights. The rates charged for motive-power, from which enormous revenues are derived, are governed by the purpose for which the water is used. On the Cavour Canal 4s. 2d. a month per horse-power is charged to the agriculturist, while the manufacturer is charged from 16s. 8d. to 80s. per annum, according to locality. In all these withdrawals it is a condition that the water be returned to the canal at the level of the motors. The canals are drawn upon for irrigation during the season for the whole of the twenty-four hours.

Baird-Smith, quoting different authorities, gives the duty of one cubic foot per second at 3 acres of marcite, 35 to 40 acres of rice, 90 acres of meadow, or 180 acres of maize or flax.

Character of Farms.

In Italy, the size of the holdings has increased rather than diminished. This was due to causes which had their origin in the troubled state of the country. Water was inseparable from the cultivation of the soil, and as the control of the supply had been secured in medieval times by influential families, the rights of the small landowners were soon absorbed by their more powerful neighbours. The farming community is composed to this day of three classes, the landowners, the tenants, and the labourers.

The farm-houses are large and commodious, and there is everywhere an appearance of well-to-do comfort. A farm of 250 acres is considered large, while the largest rarely exceed 5,000 acres. With larger holdings it is obviously easier to utilise the water to the greatest advantage.

Crops Irrigated.

The irrigated crops in Northern Italy consist of rice, meadow-land, lucerne, marcite, maize, barley, oats, rye, beetroot for sugar, and colza. Wheat is rarely irrigated; while haricôts, peas, lentils, and potatoes are only watered when occasion demands. These crops are all grown in rotation; they really require very little artificial watering. The rotation follows fixed rules, which seldom vary.

The marcite crop is the most important, 10 to 15 tons to the acre being the usual return for each cutting. This brings about £60 per annum to the farmer, against which he pays a yearly rental for land and water of about £7 10s. per acre. Oats yield up to 53 bushels an acre, wheat 34 bushels, corn 80 bushels. Lucerne is cut about six times in the year. These splendid returns are in a great measure attributable to artificial fertilisation, and so well is this appreciated that every farmer keeps as much stock as possible, and thereby secures the required enrichment of the soil. An old aphorism in Italy runs, "Who has many fields has many beasts; who has many beasts has much manure, who has much manure has much produce." Hence the large area devoted to meadows and fodder. The cattle, principally dairy cows, are stall fed for eight months in the year. Stable manure has at times to be supplemented by guano or other fertilisers. Could the rates and taxes be reduced, it is quite evident that, with such returns, small holdings might be sufficient in Italy; but under our circumstances a small irrigated holding may have to be looked upon as supplementary to a larger area where dry farming is practised.

Cultivation of Timber Trees.

A most important feature in Italian irrigation farms is the cultivation of timber trees, which border all fields save those where rice is grown. In every direction single and double rows of trees are to be seen, consisting of poplars, willows, and alders, which are planted 20 to 30 feet apart; while the acacia, oak, elm, and ash are grown for timber. In the country where silk is cultivated, especially in Cremona, mulberry-trees in double rows are abundant. I noticed our friend the eucalyptus in various localities. A large revenue is derived from these trees, which are regularly lopped, and an abundant supply of firewood thereby obtained.

Vineyards and Orchards.

In addition to these products of the irrigated country must be added the vineyards, whose wine is so justly celebrated; also olives and olive oil. Fruit abounds, and is largely exported. Although vines do not require much water, it is well known that limited irrigation preserves them from the attacks of *Phylloxera*. The orchards and vineyards are practically limited to the upper levels or mountain slopes. Near the Adriatic, flax and hemp are extensively cultivated.

Drainage.

While the valley of the Po is the most admirably irrigated district in the world, it should be equally celebrated for the excellence of its drainage works. This question has for all time occupied the attention of the people, but it is only with the advent of steam power that the work of drainage has been thoroughly accomplished. Much reclamation has also been done in the last thirty years. Upwards of 600,000 acres of marsh land in the provinces of Venetia and Emilia alone have been reclaimed and transformed into rich country.

Scientific and Technical Instruction.

Italy has in her employ a very large and efficient staff of officers, comprising administrators, engineers, and scientists; all men of the highest culture. She has her colleges and technical schools, and disseminates literature upon all subjects which affect the cultivation and prosperity of the country, with an unsparing hand. After the engineer and scientist have finished their work, then comes the irrigator, a man who knows almost by intuition, or the inherited experience of generations, every detail of preparing the land and applying the water to the best advantage. While in Australia we may in time fill the professional ranks from our universities, it will take years of experience to produce the expert irrigator such as is native to the soil of Northern Italy. It is possible that much of the irrigated land in Australia may be devoted to fruit culture, on which we have already largely and successfully experimented; so I need not now touch upon the irrigated fruit country of Italy, which in all does not exceed 600,000 acres, principally devoted to citrus fruits.

We must do much before we can in any way approach the perfection of Italian irrigation, which has been the work of centuries, and which, according to Herisson, has added £66,000,000 to the national capital. But we have her experience before us; are possessed of a climate and soil in every way her equal; and are free, and I hope ever will be, from any of the disturbing influences from which she has suffered from time immemorial. We must educate our people in the same way as the Italians have been educated, both as regards administrators, engineers, scientists, and practical irrigators. To do this properly and well, it is essential that Chairs of Agriculture, Viticulture, and Forestry should be established at our universities; that the number of our experiment farms be increased; and that those who will have to administer any of the departments under the above heads should have the opportunity of gaining experience by personal observation and of studying the methods pursued in Europe.

There are no questions which affect the wellbeing of Australia so vitally as the conservation of water (for we are not like Northern Italy, with its perennial streams); the preservation of existing forest land; and the resumption and afforestation of all catchment areas, the water supply from which will

eventually have to be drawn upon if agriculture is to be profitably pursued, and a permanent settlement assured.

It was with much pleasure that I learnt the opinion of Dr. Capra in regard to the denudation of our forest land, pointing out the close connection between water supply and forestry. He emphatically confirms the evidence given before the Forestry Commission here, whose report and minutes of evidence are of such importance.

Dr. Jordan, who was lecturing here some time since, has written that "stability of national character goes with the foothold of the soil." Therefore let us make the soil sufficiently attractive to induce our people to secure that foothold.

Irrigating Before or After Sowing.

Inquiries are frequently received as to the proper preparation of irrigated areas for seeding. Mr. F. G. Chomley, Manager of the Yanco Experiment Farm, states :—

"It is far better to irrigate first and sow after for all seeds, cereals as well as lucerne.

"In irrigating before sowing do not flood the ground, if it can be avoided, but plough furrows from 3 to 10 feet apart, according to the nature of the land. Some soils will soak 5 feet on each side of a furrow full of water ; others take a long time to soak 1 foot 6 inches sideways. If there is much to do, and the soil is likely to get hard before it can all be ploughed, run the scarifier over it as soon as the horses can work on the land ; in a few days the soil will be evenly moist, and in good condition for ploughing. The ploughed land should be scarified as soon as ploughed, or the crests of the furrows will dry hard. If convenient, harrow or scarify each day's ploughing as the work progresses. In autumn, the irrigating given for ploughing and seeding should, with average winter conditions, carry a crop of wheat, oats, &c., well into spring, when one good soaking, as the seed stalks are starting, should suffice for hay, with, if conditions are adverse, one more for grain crops.

"Lucerne sown in autumn must not be irrigated till spring on most soils unless the sowing was done very early and a fair growth has been made, when a light irrigation (if dry weather continues) may be given. Lucerne is more likely to suffer from too much moisture on the approach of cold weather than from dryness. If late-sown lucerne is irrigated before all the seed has germinated, the surface will set tight and the little leaves cannot get through."

On the discrepancy between the results obtained by Experiments in Manuring, &c., in Pots and in the Field.

LIONEL COHEN, Chemical Laboratory, Department of Agriculture.

THE very marked results produced by the use of certain manures on plants growing in culture pots, and the enormously increased yield of crop, not seldom contrast strangely with those from similar experiments with the same proportions of fertiliser, the same variety of plant, &c., when carried out in the same soil under field conditions. No entirely satisfactory explanation has, I believe, been afforded of this phenomenon, the whole question being considered, and rightly so, perhaps, as an extremely intricate one, and one in which a large number of mutually interacting physical and chemical forces have to be taken into consideration.

The problem of manuring in the light of water-supply seems to have not received the attention in the observations and researches of many workers that the subject deserves, and the questions of the application of fertilisers to the soil, and of rainfall and irrigation have been studied too much apart, but are really inextricably bound up one in another. It seems to me that a very important factor in the study of this matter has been somewhat overlooked, namely, the composition or state of concentration of the solution from which the roots derive directly the nourishment for the plant, in other words the soil moisture.

Water exists in the soil in two states, depending on atmospheric conditions, namely, hygroscopic and capillary, the term hygroscopic being applied to that condensed aqueous vapour which is retained by the soil in a dry atmosphere or absorbed by an artificially dried soil from moist air, and adheres as a film to the soil particles, and the term capillary to the water from rain, irrigation, or upward capillary action from "bottom water" which fills up more or less completely the interstices between the particles. It has been shown by repeated experiments that soil contains water-soluble salts to the extent, in the poorer and richer soils respectively, of between about ·02 and ·05 per cent., which from the method of determination may be assumed to be in a state of solution in the water, hygroscopic or capillary, that the soil contains. Now the amount of moisture varies, of course, to a very large extent in a given soil, according as the weather conditions are rainy or droughty, being sometimes as low (when hygroscopic only) as 2·5 per cent., and as high as 40 per cent. or more when "wet," that is, saturated with capillary moisture.

Read before the Royal Society of New South Wales, 7 July, 1909.

Let us now consider the growth of a seed or young plant placed in a nutrient aqueous solution—that is, pure water in which have been dissolved the acids and bases in relative proportions similar to those present in plant-ash, and we find that normal results obtain only when the solution is below a certain limit of concentration, and development becomes more and more retarded as the solution becomes stronger, until the limit of tolerance of that particular plant is reached. Let us say that this occurs when the water contains x per cent. of salts. (The numerical value of the symbol will depend on a variety of factors, such as nature of plant, habit, preponderance of one salt over another, or the presence of one, such as carbonate of soda, which exerts an apparently toxic action on certain crops.) Considering now the case of a plant growing in a pot kept moist by frequent waterings, we find that if the soil contains ·03 per cent. of salts in solution, and also averages about 25 per cent. of water, this water from which the plant is feeding will contain ·12 per cent. of salts. If then, the pot is allowed to become "dry," that is, to lose about 20 per cent. of its water (a common occurrence in droughty weather), the soil moisture then becomes a ·6 per cent. solution. We thus see what an enormous alteration in the concentration of the soil-water takes place in the ordinary drying of the surface of any soil either in the field or in the pot.

We will take the case of a culture pot in which it is intended to experiment with the manuring of the plant whose limit of endurance is x per cent. of salts, and assume that when allowed to become "dry," *i.e.,* contain about 5 per cent. of water, wilting will not occur for a day or so—in other words, that the plant will tolerate a ·6 per cent. solution. Therefore x is greater than ·6 by, say, a. Let us now add to the pot nitrate of soda or sulphate of potash or other soluble salt in quantity approximating a. Then the plant will be affected by the drying more or less injuriously, according as the quantity of manure is greater or less than a.

It is thus seen that, under field conditions, it is desirable that the value of this factor a should be known, as, except under irrigation, it is manifestly impossible to be sure that the moisture content will not decrease beyond a certain point. We also see that it is not possible to come to a definite conclusion as to the value of a manure, unless we know that the moisture conditions at least, are going to be similar, in our practical trial, to those of the few experimental plants. Here it is that the difference becomes apparent between the experiments in the pot and in the plot. It is a very easy matter to prevent drying in the former; not so in the case of the same plants in the same soil treated with similar proportions of manure in the field. The culture pot is under complete control—we see to it that it contains never less than about 20 per cent. of moisture, that is, that our soil-water is not more than a $\cdot 15 + \frac{a}{4}$ per cent. solution. But what happens on the farm? On many occasions during the progress of a field experiment the moisture goes down to 5 per cent. (causing the concentration to reach x); and here we have a theoretical instance where the development

of a crop may be seriously retarded by the application of the same proportion of the very material that, under optimum conditions of moisture, might produce a three-fold return.

As a practical example:—Nobbe, Wolff, and other Continental experimenters have proved that the growth of many farm crops is seriously hindered when the water in which their roots are suspended contains more than ·2 per cent. of soluble ash ingredients; this being the case, and supposing that we find a soil to contain ·02 per cent. of soluble salts, and we wish to add as a manure for the crop nitrate of soda, say, at the rate of 2 cwt. per acre, or ·02 per cent., then we increase the concentration in the following way:—When the unmanured soil contains 20 per cent. of moisture, the latter holds ·1 per cent of salts—a very favourable medium for assimilation; but by the addition of the manure this figure is doubled, and reaches the danger mark quoted above, and it thus becomes evident that, in order to get favourable results from this addition, it will be necessary to always keep at least 20 per cent. of moisture in the soil—a condition seldom practicable in dry countries. It is possible that in many cases farmers and others have developed an insuperable prejudice against the use of chemical fertilisers, because these had been tried on their land under conditions similar to above.

In his book, "The Soil," p. 91, A. D. Hall tells us that Dr. Sachs came to the conclusion, as the results of experiments with plants in pots, that different soils can yield up to the plant only a certain percentage of their water, basing his opinion on the observation that the plant wilted while the soil still contained a good deal of moisture, in some cases as much as 12 per cent. It was also found, by calculation, that the wilting took place in all soils when the film of hygroscopic moisture had diminished to a certain thickness, viz., about ·00003 inch. Now it has been proved by numerous investigations beyond all reasonable doubt, notwithstanding the opinion expressed by Prof. Whitney, of the United States Soil Bureau in recent papers to the contrary, that the concentration of the soil-moisture is, as a general rule, much greater in clay soils than in sandy ones; and it is just in these clay soils that Sachs found the disposition to wilt with the greatest amount of moisture; whereas in sands, the plants (tobacco in this instance) remained turgid, while only 1½ per cent. of water remained. Is it not possible that the retarded development and wilting were due to the too great concentration of the salts, manurial and otherwise, in the soil-moisture? Again, a good deal of irregularity is noticeable in the results obtained in various parts of the world as to the tolerance of certain crops to injurious salts, such as common salt and carbonate of soda.

It seems to me that the quantity of moisture present in the soil is one of the most important considerations in such experiments as, for instance, a plant would grow as well in a soil, *ceteris paribus,* containing 4 per cent. of salt and 40 per cent. of moisture, as in one containing 1 per cent. of salt and 10 per cent. of water. This is a question of great importance in some countries, notably our own, and it may not be out of place to suggest that

perhaps, if maximum and minimum moisture contents of the soils experimented on were determined, much light would be thrown on the apparent discordance of results obtained in different countries.

There is undoubted evidence that in ordinary soil of medium fertility, the use of soluble fertilisers is without profit, in fact, in certain cases, positively detrimental, unless a correspondingly large amount of water is used on the growing crop, so as to bring the soil-moisture below the maximum limit of concentration during its growth. This is an aspect of the subject of manuring to which too much attention cannot be paid, more especially in the matter of irrigation with saline waters and the correction of their alkalinity, it being borne in mind that we cannot add to the water without increasing the quantity of salts in the soil-moisture.

In the foregoing brief discussion of the subject I am sensible of not having introduced any matter entirely new, but have merely endeavoured to apply a few observations made by experimenters in other directions, to the question under consideration—one which has provided a good deal of food for thought, and the importance of which, in experimental agriculture, can hardly be overrated.

CULTIVATION WHERE IRRIGATION IS OUT OF THE QUESTION.

THE dry-land farmer must continually bear in mind that in order to succeed he must study the physical characteristics of his soil and take advantage of every possible means of conserving all the moisture that falls, whether it comes during the preparation of the land for seeding, during the growing period of the crop, or after a crop has been harvested. The foundation principle of conservation of moisture is to provide and maintain at the surface a layer of loose soil which serves to prevent the escape of moisture by evaporation. In the majority of cases it will be necessary to conserve the moisture of two seasons for a single crop; and early deep ploughing, summer tilling of the land, and so arranging the crops that two seasons' rainfall will be largely utilised for each crop, are the means of securing the desired results. The dry-land farmer cannot afford to be at all careless about any of these operations. He should also remember that every weed allowed to grow in his cultivated crop saps its proportion of the moisture from the land and robs him of a portion of his just dues.—*Report of Wyoming Agri. Exp. Station, U.S.A.*

Some Further Aspects of Bird Protection.

LAUNCELOT HARRISON,
Hon. Secretary, Wild Life Preservation Society of Australia.

A FEW months ago I read in an American magazine a statement by C. W. Beebe, Curator of Ornithology in the New York Zoological Park, that if all the birds in the world were destroyed to-morrow, man would be unable to live unless he could eke out a miserable existence upon a diet of fish. I smiled, as you are smiling; but Beebe went on, and put his case. If there were no birds, insects would increase indefinitely, and would gradually devour all vegetation. Agriculture would become an impossibility, and when all green food disappeared, herbivorous animals would become extinct. The flesh-eating creatures, deprived of their food, would die off, and man would be left alone with only the ocean to draw on for his daily bread.

So, after all, that startling sentence was only a fair statement of what we may expect if we carry our policy of bird destruction to its logical conclusion. Such a statement must arrest the attention of even the most thoughtless, and drive home the fact that bird life is something to be reckoned with in its relation to the general well-being of mankind. An individual bird may seem a small thing, not of much importance one way or the other; but if we compare its functions with our own, and then multiply it by the thousands of birds we still have with us, we may come near realising how potent a factor the bird is. Turning again to Mr. Beebe, we find on page 177 of his work "The Bird,"* that man takes thirteen to sixteen breaths in a minute, birds twenty to sixty; on page 182, that the heart of a bird beats 120 times a minute when the bird is at rest (as against man's eighty or thereabouts); and on page 186, that the normal temperature of our body is about 98½ degrees, while a little bird is healthy and comfortable with a temperature of 110 degrees to 112 degrees.

To the outward seeming these three statements may not have much to do with bird protection, but they give us the clue to the essential reason for all bird protection. The bird breathes so much faster than man, because a much more rapid combustion of oxygen is necessary to purify blood which is coursing half as fast again as it does in our sluggish veins. And an infinitely more rapid combustion of food is needed to supply and renew this swiftly-flowing blood, which is raised by all this burning of fuel to a temperature at which it would be impossible for man to exist. In a word, these three physiological facts spell appetite—such an appetite as the greatest glutton on earth may hope for in vain.

* The Bird: Its Form and Function. Westminster, Constable, 1907.

The plain facts of a bird's voraciousness, of the supply of food needed to keep its tiny furnace going, are almost incredible, as the following extracts, which are from an article by Dr. Judd, of the U.S.A. Biological Survey in the "Year Book of Department of Agriculture" for 1900, show:—

P. 411.—"A young robin kept in captivity by Professor Treadwell required sixty earth-worms a day; and the young of a pair of European jays, observed by Dr. Brewer, were fed half a million caterpillars in a single season."

P. 431.—"One young dove, which had recently left the nest, had in its crop 7,500 seeds of yellow sorrel."

P. 436.—"During the outbreak of Rocky Mountain locusts in Nebraska in 1874-1877, Professor Samuel Aughey saw a long-billed marsh wren carry thirty locusts to her young in an hour. At this rate, for seven hours a day, a brood would consume 210 locusts per day; and the passerine birds of the eastern half of Nebraska, allowing only twenty broods to a square mile, would destroy daily 162,771,000 of the pests. The average locust weighs about 15 grains, and is capable each day of consuming its own weight of standing forage crops—corn and wheat. The locusts eaten by the nestlings would therefore be able to destroy in one day 174 tons of crops, which at £2 per ton would be worth £348."

These examples are American, for we have no exact Australian experience, but I can give one rough instance to show that our insectivorous birds are no whit behind their American fellows. I was breaking a new piece of ground in my suburban garden, and a brown fly-catcher—the little brown fellow with the grey breast and white-edged tail, whom the Sydney boys call the "jacky winter," and who is elsewhere known as the "stumper," from his habit of perching on posts and low stumps—kept in close attendance, darting down every now and then and snapping up some insect at my spade heel. He was so persistent that I put a rough check on him, and reckoned that during the three hours I was digging he snapped a morsel every half-minute, or 360 mouthfuls altogether. As these included portions of earth-worms, and a small centipede taken in two instalments, friend "jacky winter" proved himself no mean trencherman.

The facts I have presented give some idea of the voracity of bird life—of the tremendous processes of devouring and digesting far beyond our human capability, such as enable a cormorant to swallow head first an eel almost as bulky as the bird itself, and to keep on passing a bit more down as the lower end is digested. I have established the bird appetite as a potent factor for good or ill, and the whole question of bird protection turns on our definition of good or ill. And I am sorry to say that we in Australia are not in a position to decide upon the question. Mr. Froggatt, in his essentially sane and thoughtful paper upon this same subject, in the May *Gazette*, tells us something of the work that has been

done by the U.S.A. Biological Survey and Department of Agriculture towards finding out the precise economic value of the various species of American birds. Yet in spite of all the statistics that have been compiled, and all the thousands of stomachs collected at all seasons of the year that have been examined, there are still many birds about whose position in the economic scale the learned gentlemen of the Biological Survey cannot make up their minds. And if such is the case, after years of careful study and close compilation of facts, what chance have we of putting bird protection on an economic basis when we have not fully studied the food supply of even half-a-dozen common species? Australia has possessed systematic ornithologists in plenty, and the systematic work has been well done; but economic ornithology—if we except the small but very useful beginnings of Mr. Musson at the Hawkesbury Agricultural College—is still an untouched field, while the men who might be breaking it are delving into priority of nomenclature and other comparatively unimportant questions.

In theory, bird protection on the economic plan is simple. Your bird eats so much that is helpful to man, and so much that is harmful. You simply balance one against the other, and if the good predominates, you protect the bird; if the bad, you condemn it. But to do this simple subtraction knowledge is required. To make our omelette of economic protection it will be necessary to break the eggs of bird lives. This may seem barbarous talk for an advocate of protection, but we will never induce the people to protect unless we can show them that it is to their advantage so to do; and all the Acts in creation will not succeed unless they have the force of public opinion behind them. It will be kinder in the long run to make a definite research and have done with it, and then to show sound reason for protecting such species as prove worthy of protection, than to allow people to exercise their own judgment, too often founded upon hasty observation and prejudice, in the destruction of birds. We may be fairly certain by analogy with researches that have taken place elsewhere, that most of our birds will come through the ordeal safely.

Research work must be done, and correct inferences must be drawn from the results. No room must be left for prejudice, which plays such a large part in our present consideration of bird life. To take one family alone, what could be more misguided than the attitude which is maintained towards the hawks and their relations? Mr. Froggatt has taken me to task because I suggested their protection. Well, perhaps he is right as far as the wedge-tailed eagle, or eagle-hawk, goes. It certainly does take a small percentage of lambs among its food, but the one piece of evidence he adduces to its discredit is that he has seen forty round the carcase of a single sheep. Surely that means nothing more than that the bird is a very useful scavenger, for there can be no suggestion that an eagle, or even forty of them, could kill a full-grown sheep. Some time ago a young fellow was collecting a small series of eagles' eggs

for me up on the Castlereagh River. I asked him to watch particularly what food was taken to the nests, and he told me that he always knew when a nest was occupied by the number of dead rabbits lying beneath it, and that in about a dozen nests which he examined he did not find one lamb. But that does not alter the fact that it does take lambs, and no matter how well it may pay for them with the marsupial and rodent grass-eaters it destroys, sheep men will never forgive it. Still, I maintain that no one has yet proved it not worthy of protection.

Turning to the smaller hawks, however, the reason for their persecution is very hard to understand. The only possible harm they can do is to lift a stray chicken or two; and I am pretty well convinced that the loss of poultry occasioned by hawks would not amount to £100 in a year throughout the whole of Australia—an economic loss which is absolutely negligible. On the other hand the good they do is simply inestimable. As scavengers, the wedge-tailed eagle and kite do great work; as devourers of ground vermin all the hawks work in the interests of man; but it is as insect-eaters that the hawks excel. The beautiful kestrel and still more beautiful black-shouldered kite are almost purely insectivorous, and even so large a bird as the whistling eagle, which is the commonest bird of prey in Australia, does not despise insect food, but follows up the plagues of caterpillars and grasshoppers till it becomes gorged to repletion. Some hawks, such as the falcons and the sparrow-hawks, are more prone to attack poultry than others; but, as I have already said, the depredations of hawks really do not cause any economic loss, and reference to any work of Australian ornithology will give any inquirer abundant evidence of the good work they do. Yet all hawks, and one or two other birds that have the misfortune to resemble them, are shot on sight, and even so reliable an observer and old hand in the bush as Mr. Froggatt scoffs at the idea of protecting them.

We want exact statistics, and we want to make a proper use of them, but even then something further will be required. A sheep is a valuable animal, and its fleece fetches a pretty penny every year, but a man with 10,000 acres, despite his knowledge that 50,000 sheep are worth more than 10,000, does not place the larger number upon his property. Similarly, a fruit-tree is a very pleasant thing, yet no man plants his fruit-trees 3 feet apart so as to have more of them. So with the birds. When we have, in our wisdom, settled that we shall protect this, that, and the other, we must exercise a supervision, and see that we do not protect them too much. "The balance of Nature" has been hurled at us until we are all nauseated at the sound of it, but the trouble is that we cannot dodge its truth. Mr. Froggatt gives us a good example in his Victorian magpie story. First of all Nature stood at the helm, and having had a good deal of practice at adjusting all these small difficulties, kept things on a fairly even keel, and the magpies were very useful birds. Then closer settlement brought along more man, with his dogs and his guns and his poison. He improved on Nature by killing all the hawks,

and the magpies waxed in numbers, and being short of insects, ate seedling wheat. So man shot the magpies, and probably the cut-worms have been having a good time ever since. Thus we see that first the hawks were destroyed, and then the magpies, while if the hawks had been left alone the magpies would have required no attention. The lesson that we have to learn is that almost every act of man, whether in destroying birds or animals, or simply in clearing and ringbarking, has some marked effect on the fauna in his district. If we overstock useful birds by clearing out their natural enemies, Nature is bound to revenge herself for our interference in her affairs by adding to the too numerous species some cheerful habit on which we had not previously reckoned.

So the thing to aim at is to find out the noxious species and to weed them out; then to watch for and counteract the effects of this weeding out upon the remaining species, and generally to keep a watchful eye upon the balance of species. As Mr. Froggatt has pointed out, there will be many problems to solve; many birds which are useful in one district and pests in another; and many species that are harmful at one season and helpful at another. One small puzzle I have often worried over. The bronze cuckoo is a useful bird, one of the few that eat hairy caterpillars, and almost the only one that will tackle the larvæ of the vine moth. But the bronze cuckoo is parasitic in habit, and foists its egg upon any one of the small tits, upon whom devolves the task of hatching the egg out. Now the tits are useful birds, among the most useful we have, for they are numerous and persevering, and their prying eyes find and their sharp bills devour myriads of tiny insects. When the young bronze cuckoo hatches, his first act is to infringe the "Birds Protection Act of 1901" by throwing out his three small foster-brothers to die miserably. This is necessary, for the cuckoo will ultimately be a much larger bird than the tit, and requires all the food that both parents can bring him for his proper development. So every bronze cuckoo that is gained involves the loss of three tits, and the puzzle is—Is a bronze cuckoo worth it?

If this and all the other problems are to be solved, and if bird protection is to be placed on an economic basis, someone will have to do the preliminary work of finding out things, and it seems to me that this should be the work of the Department of Agriculture. The matter is of urgent importance. Already bird destruction is bearing its result in the shape of increasing insect plagues. We do not want to reach the same pass as New Zealand, which has killed off its indigenous birds, and has had to acclimatise foreigners to take their places. We cannot do without birds, and we have had numerous object-lessons already to warn us of the dangers of acclimatisation. Until some Government action is taken the Wild Life Preservation Society will endeavour to do what it can towards acquiring and spreading knowledge, and will be glad to hear from all who are interested in the question and in a position to help it.

There is another aspect of bird protection, however, which is entitled to consideration. We must not confine ourselves absolutely to the cold-blooded economic view-point, however estimable that may be. Every man, even though he may not be exactly a bird lover, takes some interest in the beauty and song of birds, and would miss both were they taken away. And we have in Australia a very beautiful and varied bird fauna, of which we are, after all, only trustees. We owe it to our posterity to hand down this fauna intact, or with as little reduction as possible. Many of our most beautiful birds, so remarkable as to rank as national emblems, are becoming rare simply owing to wanton and thoughtless destruction. We must do what we can to educate the younger generation and to give it a proper idea of the value of bird life, both economically and æsthetically. Teach the young idea how to shoot, if you will, but teach it that there is nothing more ignoble than the reduction of a beautiful living creature to a bundle of blood-stained feathers.

Sparrows in Condobolin District.

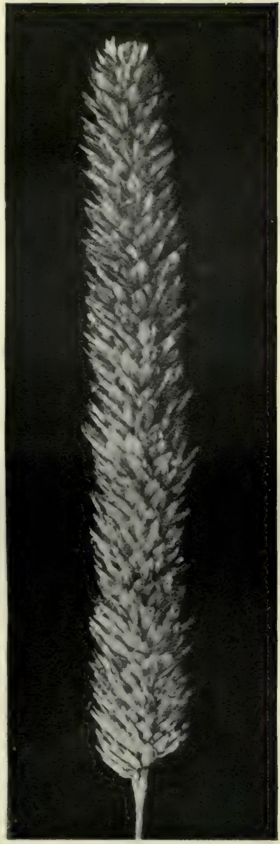
Mr. H. F. Parsons, in a letter to the Principal of the Hawkesbury Agricultural College, says:—

Turning over some old files of the *Agricultural Gazette*, under date 3rd April, 1905, I came across a circular from you, making inquiries *re* the presence of sparrows and the best means of destruction in various places.

I farm about 300 acres of wheat, and run sheep. In my neighbourhood we are all mixed farmers, residing about 11 miles from the Condobolin railway station. Every homestead here has its own flock of sparrows, more or less. In Condobolin town one meets them at every turn. They are thoroughly acclimatised. My own little flock ranged between 500 and 1,000. They flew about in a cloud, and when they lighted on a stack it would become brown in colour with them. They were my despair. Every afternoon I raked up the straw that they had pulled out during the day, and found the same sufficient to feed a horse.

I tried all known remedies, and never got even one sparrow. Ultimately they got so bad that I had to cover my stack in with cloths till it ran out, in June. I finished sowing seed-wheat just about that time, and had occasion to plant a plot close to the house. The "cloud" descended on the newly-sown land. I then tried a new idea. Instead of soaking the seed, I ground strychnine to powder, and putting a quart of wheat in an old tin, I sprinkled enough water over the grain to properly dampen it. Then, by means of a table-spoon, I thoroughly stirred one teaspoonful of the powdered poison amongst the wheat, until each grain got its share of strychnine dust. The grain was then sown with the spoon. I got several hundred sparrows straight off. Then alternating clean wheat for a term, and substituting again with poisoned, great havoc was wrought, and the cloud of sparrows is now reduced to about twenty. I rather fancy my own balance is being reinforced from neighbouring colonies; but all the same "I got there."

I wish to be particularly emphatic on the point that they will not take poison at all times of the year. The very plan that is now being such a pronounced success (middle of August) was an utter failure in autumn; but in July and August there are very few seeds about, and the sparrows will take poisoned grain. I am of opinion that were poisoning of sparrows on the plan I have described made general and compulsory by legislation, the sparrow pest would be minimised to lowest levels.



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PHALARIS COMMUTATA (SO-CALLED).

Fig. 2—Fruiting spike (life size). **Fig. 3**—Group of spikes (somewhat reduced) showing variation in size.

Fig. 4.—Stand of *P. commutata*, nine months from seed, from trial grounds of Messrs. Yates & Co., Concord.

Phalaris commutata (so called).

J. H. MAIDEN.

THERE is an excellent article in regard to the grass so named in Australia, from the pen of Professor Ewart, in the *Journal of the Department of Agriculture for Victoria* for December last. As Professor Ewart was dealing with the matter, I held over my notes on the grass, which I was preparing for publication, especially as I also had been in correspondence with Kew on the subject. But a number of New South Wales correspondents desire further information, and it may be well to state that there is at present a difference of opinion between the two leading authorities on grasses, viz., Professor Häckel, of Austria, and Dr. Stapf, of Kew. The former inclines to the opinion that the Australian cultivated grass is a new species intermediate between *Phalaris bulbosa*, L., a common Mediterranean species, and *P. arundinacea*, L., the Reed canary grass of the eastern United States, and common also in the north of Europe.

The latter considers it to be simply *P. bulbosa*, L. (non Cav.).

Dr. Stapf writes to me recently on the subject:—

We have just received a specimen of the *Phalaris commutata* of South Africa from Mr. M. Wood, Durban, Natal. It turns out to be the common Mediterranean *Phalaris bulbosa*, L. (non Cav.). It is also often enumerated as *P. nodosa*, L., as Linnæus named it so later on (1774). The bulbous thickening of the short basal internodes is not well marked in the South African plant; but this may be due to the effects of cultivation in good soil. The species is easily recognised by the hairy, fertile glume, which is supported by two very small barren glumes, one of which is a mere tiny callous scale (*a*), whilst the other (*b*) consists of such a scale, plus a slender, membranous, pubescent appendage about one-third the length of the fertile glume, as shown in the figure.

I enclose a copy of Mr. Wood's letter so far as it concerns this question—

"Referring to your request for specimens of the grass known here as *Phalaris commutata*, I have to say that I wrote at once to Mr. Geo. Carter, and have received good specimens which are now drying, and will, if ready, be sent to you by the next mail. All that I know of the grass is that during the last year our Curator told me that a person wished us to obtain for him seeds of *P. commutata*, and he asked me where he would be likely to obtain them. I referred him to the "Index Kewensis," and told him that the name was a synonym of *P. coerulescens*, Desf., and told him to ask a correspondent in Italy for that species. When the seeds arrived, a few were planted here, and did very well; when in flower I had a specimen dried for the Herbarium. I have seen a specimen of same grass from Mouillefarine, gathered in France; I have compared these three specimens, and they appear to be identical, but I shall be glad to have your opinion on the matter." [Copied from a letter by Mr. J. Medley Wood, Durban, Natal, to the Director, Royal Gardens, Kew.]

(The Index Kewensis gives probably *Phalaris bulbosa*, L., as *P. tuberosa*, L., *i.e.*, *P. nodosa* is referred to *P. tuberosa*; *P. bulbosa* is referred to *Phleum*. There is confusion in the synonymy in the Index Kewensis.—J.H.M.)

Last year (November, 14) the Director of the Royal Gardens at Kew (Colonel Prain) wrote me, enclosing a memorandum of Dr. Stapf.—

We have no typical specimen of *Phalaris commutata*, R. and S. This is what Parlatore says about it (*Fl. Ital.* i. 70): "La *Phalaris commutata* di Roemer et Schultes syst. veg. 2, page 403, stabilita secondo il Bertoloni, sulla radice ē la pianta della *Phalaris*

nodosa, e sulla pannocchia della *Phalaris minor*, deve essere scancellata dal numero delle specie e quindi tolta dalla flora Italiana, perche creduta trovarsi in Genova sopra il Lagazzo "—

Which Mr. Musso kindly translates—

The *Phalaris commutata* of Roemer and Schultz, syst. veg. 2, page 403, established according to Bertoloni, on the root and the plant of the *Phalaris nodosa*, and on the panicle of the *Phalaris minor*, must be cancelled from the number of the species, and taken out of the Italian flora, because it was thought to have been found in Genoa on the Lagazzo.

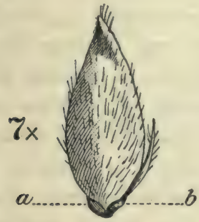


Fig. 1.

Dr. Stapf's figure of a fertile glume of *P. bulbosa*, L., is reproduced herewith, and all the specimens of *P. commutata* that I have received from correspondents have a similar glume.

If Professor Häckel decides to constitute the grass a new species, I will inform readers of the *Gazette* to that effect, meantime, all specimens of *P. commutata*, Rœm. et Schult., are labelled in the National Herbarium of New South Wales *P. bulbosa*, L. (non Cav.).

I get favourable reports of this grass, and reports not so good. It is early yet to say what its true value is, for although it has been grown at Toowoomba for many years, it has not been extensively grown for long. The pity is that when a grass has proved useful in one place, or during one season, some persons look upon it as equally valuable for all districts, soils, and climates. Every property should rely on more than one grass, perhaps on several. A farmer or pastoralist should make it his business to ascertain the names of the grasses, good, bad, and indifferent, on his property.

Cats' Heads (*Emex australis*, Steinh.).

This weed, which is well depicted by Mr. Grosse in the accompanying plate, is a noxious plant in all respects. It monopolises the best soil, smothers useful herbage and grasses, and produces large quantities of spiny seeds, which are capable of inflicting severe pain and probably injury to stock.

This bad weed puts in an appearance about this time of the year, and should be attacked with the hoe on a small scale, and the scarifier where it has become widely established.

CATS' HEADS.
[EMEX AUSTRALIS, STEINH.]

Artesian Water.

In a report to the Under Secretary respecting his investigations of artesian bores in the Coonamble district, Mr. R. S. Symmonds, of the Chemist's Branch, says :—

When a bore is put down it is usual to pass through several water-bearing strata, each of which is sealed above and below by an impervious or water-tight stratum. This impervious stratum has probably been produced by the alkali in the water acting upon the clay, and thereby converting it into a colloidal condition; in short, the water has made its own casing.

The practice has been, until recently, to sink a well until a flow sufficient for requirements is obtained. The casing is then perforated or slotted opposite the various water-bearing strata, the water from each stratum being allowed to mix to make up the quantity or flow. The water thus obtained is analysed and the saline contents returned as grains per imperial gallon.

In the Coonamble district, several shallow bore-streams contained over 50 grains of carbonate of soda per gallon; after flowing for years the bores have been sunk to bed-rock. I refer particularly to one on Wingadee and another on Quambone. The analyses made by Mr. J. Mingaye of these waters show that the carbonate of soda in each of these wells has been reduced to about half since the water from the lower levels is included in the flow; another very important feature is the water now contains potash and lime, both excellent fertilisers.

No attempt, so far as I can glean, has been made to analyse the waters from the various levels separately. The general idea has been to get quantity, and the quality as applied to agriculture has not yet been investigated. This is an important point, and in a measure, probably explains why some are successful for a longer period than others, when using the water for irrigation purpose. It is well to remember that the bores referred to on Wingadee and Quambone, both contain in their present flow the water from the higher and lower levels. When we consider that the amount of soda has been reduced by half, it is reasonable to assume that by cutting off certain of the flows from the higher levels, the amount of soda in the water from these bores would be reduced to about 12 grains per gallon, without reducing the potash and lime.

The Nebea bore in the Coonamble district has a flow of 671,748 gallons per diem, which contains carbonate of soda 8·727 grains, carbonate of potash 3·5 grains, and carbonate of lime 5·8 grains per gallon. The manurial value of the potash produced by this bore is about £760 per annum, and the carbonate of lime is worth about £150 per annum. For another example let us take the Woodlands bore: The water from this bore contains only 7·731 grains of carbonate of soda per gallon, and produces about £250 worth of potash and £100 worth of lime per annum. The orchard and paddocks irrigated by this water give excellent results at the present time, which one might expect with that amount of potash and lime. With the soda converted to nitrate this water would become an ideal fertilising stream of immense value.

It would be a simple matter to take a sample of water from each flow, when sinking new bores, and by analysis ascertain which is the best water for irrigation purposes; having determined that point there should be no difficulty in shutting off the impure or highly mineralised water, as it is possible to shut off any or all of the flows. On the other hand, if it is imperative to have quantity, the water for stock could, by lowering the 8-inch casing, be brought up between the 6-inch and 8-inch casing. The water for irrigation purposes could then flow up the 6-inch casing. The suggestions made above are worthy of speedy investigations.

Mr. K. Beaton, Engineer for the Shire of Wingadee, drew my attention to the presence of gypsum (locally known as "copi") in the Coonamble district. This substance is used extensively in America and elsewhere, to correct the injurious effects of alkali on the soil and vegetation. Of the extent and availability of these deposits of gypsum I cannot speak authoritatively, but several gentlemen assured me that it could be obtained in large quantities in the district.

The Mayor of Coonamble (Mr. Mills) drew my attention to the action of artesian water on the bore-casing and the iron tank from which the town supply is drawn. Both

are very badly pitted and corroded, indeed the bore after a few years was provided with new casing, as the original casing was completely riddled. Mr. Tibbits, Public Works Engineer for the district, produced a piece of casing from another bore, which was very badly corroded, and assured me that it was practically eaten away in a few months.

This is, undoubtedly, a very serious matter, and I venture to put forward what I believe to be the explanation of the cause of this trouble, and the reason why some of the bore-casings are as sound to-day as they were the day they were put down, thirteen years ago. Briefly, the cause of this trouble appears to me to be galvanic or "local action," between the uncombined carbon in the casing and the iron, which results in the iron g oing into solution. It is well known that some of the carbon in iron and steel is only mechanically mixed instead of being chemically combined. I am of the opinion that when the carbon is chemically combined with the iron, there is no local action and the casing is not affected, but when the carbon is only mechanically mixed "local action" takes place and is accelerated by the heat of the water, which in some cases is so high as 132 degrees Fahr.

It is a curious fact that carbonate of soda, which is the chief salt in artesian water, is frequently recommended to prevent the pitting and corroding of steam-boilers; clearly it does not prevent the corrosion of casing; at the same time it is interesting to note that in marine boilers where condensed (practically distilled) water is used, the pitting and corroding of the plates is a very serious matter. The solution of this problem is of considerable moment, and an investigation on the lines indicated would probably result in some good.

Adverting to the production of nitrates from atmospheric nitrogen, it is interesting to note that the Germans are alive to, and realise, the importance of this matter.

I attach a cutting from the *London Times*, which shows they have secured the Scandinavian water-falls, and set aside £2,000,000 for the purpose of dealing with the production of electro-chemical nitric acid.

A report dealing with the injury done by artesian water on the soil in the Coonamble district will be made when the samples collected have been examined.

The question raised by Mr. Symmonds in respect to casing was brought under the notice of Professor Fawsitt, of Sydney University, who states:—

There is undoubtedly galvanic action between the regions of pure iron and those of carbide of iron which exist in a steel casing. The subject of corrosion is one to which a large amount of attention has recently been given, but little of practical value has been so far obtained from corrosion research.

Professor Fawsitt adds that he will be glad to arrange for the examination of samples of corroded casing.

The Works Department has been asked to obtain samples of water from different levels as new bores are being sunk, in order that the waters may be analysed and the quantities of soda or other substances ascertained, and has undertaken to take the necessary action in the case of fresh bores.

Brazil Nuts for Trial.

Through the courtesy of Mr. Jas. Hart, Director of the Experiment Station, Brazil, a quantity of nuts—the common Brazil nut Bertholetia, and a more delicate variety known as the Sapucaya nut—have been obtained for trial.

The Bertholetia tree attains enormous proportions, and the rough-skinned, angular nuts are borne in a capsule, which contain twenty or more, and is hermetically sealed. In the case of the Sapucaya, the nuts are borne in the same way, but the capsule has a lid, which flies off when mature, and the nuts are scattered in all directions. The nuts arrived in good condition, and have been distributed in the North Coast district for trial.

Feeding of Pigs.

[Continued from page 578.]

H. W. POTTS, Principal, Hawkesbury Agricultural College.

XIV.

CEREALS.

THE grains of all cereals are more or less suitable for pigs, and supply large quantities of nutriment in small bulk. In all cases the market value of this class of food has to be estimated keenly to justify their use in fattening. The margin between the cost for feed and the returns from the butcher or buyer must be the guiding influence in the selection of the ration.

In many instances a class of grain is available for pig feed that would be unprofitable under other conditions.

The pig is constantly present on the farm as a scavenger, and will convert into a saleable product unmarketable residues from many crops.

All cereals vary in composition owing to the influencing factors of soil, season, climate, available fertilisers, and other conditions. In this connection it may be mentioned that wheat and oats are more subject to such influences than barley or rye, and provide more protein or flesh-forming material on rich soils.

Wheat.

Shrivelled wheat affords a profitable outlet in feeding pigs.

Under normal market conditions wheat is an economical food, and contrasts favourably with maize in its power to fatten. It may be well to note the value in food constituents which the Division of Chemistry of the United States Department of Agriculture calculates about equal to maize, when both maize and wheat are selling at the same price per bushel, with the difference that in wheat there is 2½ lb. more protein per bushel, and in maize 2½ lb. more carbohydrates. It is approximately estimated that 4½ lb. of wheat grain will produce 1 lb. live weight in young pigs.

In all cases wheat gives better results when subjected to soaking for eighteen to twenty-four hours. Whenever soaking is adopted it is well to remember not to feed more than the animal is likely to eat, seeing in our warm climate if any be left in the troughs for a lengthened period fermentation sets in and renders this food unsuitable. In the central districts of New South Wales where wheat is the staple crop, and with market rates favourable, this grain can be utilised for pig-raising.

Pollard.

Pollard, shorts, sharps, middlings are synonymous or interchangeable terms.

It contains part bran and flour with the germs of the wheat grains. This class of food is especially nutritious for pigs, and is used very largely in dairying districts where it is fed with skim-milk to top off pigs for market.

During the fattening period pollard can be judiciously mixed with skim-milk, maize, root-crops, potatoes, barley, or rye. When fed alone it is liable to produce soft flesh.

A mixture of maize-meal and pollard, or barley and pollard, will give a heavier yield of pork then when maize or barley is fed alone.

Bran

Is not found to be a payable class of food for pigs, especially when fed alone or where it forms a large percentage of the ration. We all know it to be an excellent food for cows, but with the pig the effect is quite different. The animal finds bran difficult of digestion. It has a lower nutritive value than pollard, barley, or rye. This is chiefly due to the high proportion of inert matter found in bran and its coarse fibrinous nature. With young pigs it has been noted that it is not all digested.

Bran may be regarded only as a complementary food in the pig ration. In cases of sows suckling a litter it has been found useful in maintaining the milk flow, and as a laxative food.

Gluten

Is obtained as a bye-product in the manufacture of wheat starch, and is found a useful food for fattening pigs, seeing it contains a high percentage of protein, and may be profitably blended with starchy foods. It can be had at times at a cheap rate for pig feed.

Barley.

This grain is extensively used in England and Northern Europe for pork production, and excels all other grains for producing flesh of fine quality, both as to firmness, texture, and flavour.

It may be given as a grain soaked with skim-milk, with skim-milk and boiled potatoes, or in combination with root crops, or general grazing pasturage. The digestible protein is higher in barley than in oats or maize.

As with other cereals the price of this grain must be the guiding influence in its use for raising pork and bacon. Barley flourishes well in several parts of the State, more especially in the New England district. Where its use can possibly be more extended is in those districts where barley can be fed in conjunction with lucerne.

Oats.

This cereal given to young pigs has been found to give good returns. In all cases the grain is best given ground or crushed. The best combination is with maize-meal, one-third of the former to two-thirds of the latter. With sows just farrowed the addition of oatmeal to the ration will increase the milk flow.

Oatmeal has also been found an admirable adjunct to potatoes, where they are available at a cheap rate.

Our experience of feeding with oats is very favourable, but their use depends solely on market conditions.

Rye.

This cereal has a dual purpose in the pig food. The straw is used for bedding and the grain for feed. The latter is not equal to wheat, barley, or oats, in so far as the protein contents are smaller, but the carbohydrates form an important element.

Attention is directed to the growth of rye in many districts, where it can be produced on poor, light, sandy soils with good returns, and where the more valuable cereals could not possibly thrive.

In no case should rye be fed alone. It will do to mix with other foods, such as maize, skim-milk, root-crops, and as an adjunct to pasturage. Like other cereals it is best assimilated when soaked. As a green forage crop rye has good qualifications. The best time to turn in pigs is just before heading and prior to full bloom.

Rice.

Paddy rice is largely dealt with in Australian mills, and in the process of milling and polishing for the finished article, considerable quantities of bye-products are produced in the form of rice pollard, or middlings.

A good sample contains 12 per cent. protein, 12 per cent. fat, and 50 per cent. starch. When fresh it serves as an ideal food for fattening pigs. It has the advantage of being more easily digested than the majority of other pig feeds. It can be used for feeding with skim-milk.

ANALYSIS of Mill Products.

	Pollard.	Bran.	Oatmeal Pollard.	Rice Pollard.	Barley Pollard.
	per cent.	per cent.	per cent.	per cent.	per cent.
Water	12·24	10·6	4·54	9·71	10·89
Ash	3·22	6·1	3·61	9·37	4·86
Protein	15·18	14·82	14·88	12·81	14·16
Crude Fibre	3·93	11·1	17·13	4·86	7·89
Carbo-hydrates (starch).	60·79	53·59	51·75	50·64	57·1
Fat	4·64	3·79	7·89	12·61	5·1

The above shows a close approximation in the composition of these foods and indicates their food value for pigs.

(*To be continued.*)

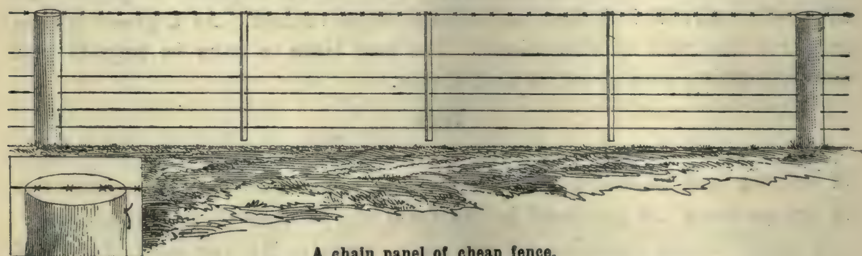
A Cheap Sheep and Cattle-proof Fence.

H. ROSS, Inspector of Agriculture.

A TOPIC which is always of interest and importance to the man on the land is that which relates to the construction of cheap and effectively stock-proof boundary and subdivisional fencing.

Post-and-rail structures are almost a thing of the past; they have had to give way in late years to the more modern and cheaper method of using wire. But even in the construction of wire fences a diversity of opinion appears to exist, for while some fences may be encountered with posts 6 feet apart, in others, again, the panels vary from 12 feet to 33 feet, or more, with a height of from 4 to 5 feet, containing anything from four to seven wires.

It has no doubt been frequently noticed that the closer the posts are situated in a wire fence, the easier it will be for sheep or cattle to get through. This is on account of the wires in each panel not giving with or yielding tc the pressure applied by the animal, thus offering an easy means to squeeze through in some way or other.



A chain panel of cheap fence.
Split posts would prove better than those shown in this diagram.

Instances have come under my notice where cattle will manage to get through a six-wire fence, with posts 9 or 12 feet apart, by lying on the ground and pushing their bodies through between the ground and the first wire. We need only try to get through this class of fence ourselves to find how easy it is to accomplish; in fact, if a man finds little difficulty in getting through a fence, such well-known ramblers as, for instance, Lincoln rams will find it a matter of the utmost simplicity. To endeavour to remedy this defect, and lessen the somewhat heavy outlay incurred in fencing, is the object of this article.

At the beginning, I may say that to erect posts at shorter distances than 33 feet apart is not only not strengthening the panels, but is also so much waste of money incurred in putting up needless posts, sinking holes, boring, &c.; in fact, the kind of fence advocated here has posts not less than 1 chain apart, is 3 feet 4 inches high, and has five plain and one barbed wire.

In estimating the cost of erection, may it be either sheds, outbuildings, or fences, due consideration must be given to locality, supply of timber,

rail freight, availability of labour, &c.; but in the subjoined estimates, I think it will be admitted that, if anything, I have rather over, than under, estimated the cost of material and labour, for 1 mile of fencing.

As stated previously, posts are to be erected 1 chain apart, 3 feet 4 inches above ground, and from 20 to 22 inches in the ground.

If posts can be procured on the farmer's own place, the cost of splitting will be 22s. 6d. per 100; if they have to be procured from any distance, 32s. 6d. per 100, delivered on the proposed line of fencing, will be found to be a reasonable estimate.

Digging eighty post-holes and placing posts in position, 15s.

Boring holes in posts for five plain wires and one hole near the edge on top of post for fastening barbed wire, 6s.

The first hole to be 6 inches, the second 11 inches, the third 16 inches, the fourth 21 inches, and the fifth 28 inches from the ground. The barbed wire will be placed on top of the posts, leaving a space of 12 inches between the last plain wire and the barbed wire, which should not be fixed on with staples, but with a piece of wire inserted through the top hole bored near the edge, and made fast by twisting.

No. 8 fencing-wire should be used, the cost of which is about 12s. per cwt. There are nearly 25 chains in 1 cwt., so the total quantity required would be 16 cwt., at 12s. per cwt., equal to £9 10s. per mile.

Barbed wire will run from 16 to 17 chains per cwt., and cost from 16s. to 18s. per cwt., or £4 10s. per mile.

Pulling wires through and straining, 12s.

Three droppers are required for each panel, or a total of 240.

While the old-time iron dropper had little to recommend it, there have lately been put on the market several makes whose stoutness, durability, and facility to strain wires without attaching the droppers have proved them to be more economical than wooden ones. Droppers may be obtained, according to quality, with any gauge or length required, from 15s. per 100 upwards, but a good serviceable article, suited for all stock (sheep, cattle, and horses), will cost about 36s. per 100, equal to £4 6s. 6d. Fixing droppers will cost 6s.

The total cost, then, would be:—

	£	s.	d.
Eighty posts, at £1 12s. 6d. per 100	1	6	0
Sinking holes and erecting	0	15	0
Boring holes in posts	0	6	0
16 cwt. No. 8 fencing wire, 12s. per cwt.	9	12	0
5 cwt. barbed wire, at 18s. per cwt.	4	10	0
Pulling wires through and straining	0	12	0
240 droppers, at 36s. per 100	4	6	6
Fixing droppers	0	6	0
Total	£21	13	6

It will be noticed that allowance has been made for all labour to be done at contract prices. If the farmer employs weekly labour, and the work be done at the slack time of the year, the above cost will be considerably diminished.

Droppers which are referred to in another part of this issue are quoted at 32s. per 100, free on rail at Sydney. The rail freight per 100 droppers for, say, 350 miles, is 6s. 3d., so that the cost of landing on the fence-line would be slightly more than indicated; but the cost of affixing improved droppers, without ties, would be very much less.

Now, this class of fence can be erected at fully £10 per mile cheaper than fences whose posts are, say, from 9 to 14 feet apart. It is, however, not only on account of its cheapness that it ought to commend itself to the farmers' notice, but also on account of its durability and sheep and cattle-proof qualities. It will be found that it is next to an impossibility for a sheep to get through it. Lincoln rams have purposely been driven against such a fence, only to find that the "spring," of the wide panels will send them flying back.

While its height is sufficient to prevent cattle and horses reaching over the barbed wire to eat the standing crop, the opening between the last plain and barbed wires is sufficiently low to prevent them getting their heads through that way.

The risk of damage from fire is reduced to a minimum, and owing to the growing scarcity of timber suitable for posts, the reduced number required is a point worthy of serious consideration.

Fences of this description have been erected in several wheat-growing centres, and have given more satisfaction than the class of fence in use hitherto.

Mr. J. Donaldson, of Sproule's Lagoon, Temora, whose subdivisional fences are built on these lines, has subjected them to some very severe tests. He concludes that not only a considerable saving (£10 per mile) is effected by their erection, but also that they are effectively stock-proof.

Diseases of Poultry.

A second and much enlarged edition of Bulletin No. 15, on the Diseases of Poultry, has been prepared, and copies are now available for free distribution to *bonâ fide* agriculturists and poultry farmers, on application to the Under Secretary, Department of Agriculture, Sydney.

Agricultural Co-operative Societies in Australasia.

With the object of placing before the agricultural community reliable and recent information as to the scope and constitution of co-operative organisations for handling Australasian farm produce, reports have been obtained, through the respective Departments of Agriculture, from several leading co-operative societies.

The New Zealand Farmers' Co-operative Association of Canterbury, Limited.

The Manager, Mr. E. W. Relph, states:—"Our business is a varied one. We supply farmers with all their requirements, both from a domestic point of view and for their agricultural purposes, and, on the other hand, we lay ourselves out to manipulate as much of their produce as possible in the shape of meat, which is dealt with through our London office. We also ship large quantities of wool and grain through the same channel, and having agencies throughout the various centres of the Dominion, we filter considerable quantities of grain stuff through these agents; and in dealing with this produce we act either as brokers—that is to say, we sell on commission—or we, if the farmer prefers it, buy the produce right out, and then deal with the stuff on our own account as merchants.

"We have a number of branches located in various parts of the Province, and their business, only in a small way, is upon parallel lines with those of our headquarters in Christchurch. We also do a large live-stock and land auctioneering business.

"The authorised capital of the New Zealand Farmers' Co-operative Association of Canterbury (Limited) is £350,000, and capital subscribed £309,460.

"For the twelve months ending 31st July, 1908, the profits were £76,546, made up as follow:—

	£
"On Merchandise	56,790
Commission, &c.	13,360
Discounts, exchanges, and interest ..	6,058
Storages	290
Transfer fees	47

"For the same period, the expenses of all kinds, including £809 bad debts, came to about £49,000, leaving a credit balance of over £32,000 for the year."

The South Australian Farmers' Co-operative Union, Limited.

The Secretary, Mr. T. E. Gelland, states:—"We have been in existence twenty-one years; we have 4,500 registered shareholders; 100 agencies opened, where we receive and distribute cornsacks and wool-packs, and take orders for all lines of business that we handle. We also have fifty or sixty sub-agents to these, dealing in smaller lines and booking-up orders.

"Last year we received close on 4,000,000 bushels of wheat, nearly the whole of which was shipped direct to England.

"We pay for wheat at each agency, and the price is regulated from the one central point, Port Adelaide. At each out-port we pay within ½d. or 1d. of Port Adelaide prices, according to the facilities for shipping.

"We handled over 9,000 bales of wool last year, at a reduced commission to the farmers.

"We distributed over 12,000 tons of manure, sold 400 or 500 harvesters, drills, binders, oil engines, and ploughs, to say nothing of hundreds of smaller lines.

"We import several thousands of pounds worth of merchandise per annum, such as wire netting, ordinary wire, standards, &c., and distribute them amongst the farmers.

"We have large central offices in the city, and also grain and wool stores at Port Adelaide. Our stores there measure over 700 feet long and 200 feet wide, and we have about twenty sheds in different parts of the State, where we store our wheat, which is held on account of farmers.

"The business is managed by seven directors, elected from the shareholders, and all of them take their turn in the office, for a month at a time, as the farmers' representative, and are styled the managing director for the time being. They are practically the head of the institution.

"Each head of department manages his own business in detail, but the finances and policy are controlled by the Board of Directors, with the secretary.

"Last year, which ended on 30th June, we came out with a profit of about £28,000, which is the largest on record so far, but then our turnover has been nearly double that of any previous year."

Mr. Gelland adds that the association is now formulating a small library of useful information for farmers when they are in the city.

Eudunda Farmers' Co-operative Society.

The objects of this society, which was formed in 1896, with headquarters at Adelaide, are to purchase for the use of members all sorts of commodities for domestic and farm use, and to handle farm produce.

In 1897, the membership was 140, the shares represented £110; there was no reserve and no profit. On 1st April, 1909, the members numbered 1,006, the shares represented £17,734; there was £1,668 in the reserve fund, the capital was set down at £21,055, and the profits for twelve months £2,468.

Membership is restricted to producers. Each member must hold at least one paid-up £1 share during the first year and increase his liability each year until he holds five paid-up shares. No member shall hold more than 200 shares. The management of the society is vested in an elected committee of five members. The committee elect their own chairman. The committee must meet at least once a month. The secretary is really the executive officer of the society.

This year the profits, amounting to £1,651, were distributed as follow:—

Interest on shares, 5 per cent.
Bonus to store purchasers, 1s. in the £.
Bonus to wood purchasers, 6d. in the £.
Interest on loans, 4 per cent.
Bonus to store managers.
Balance to reserve fund.

Margarine.

M. A. O'CALLAGHAN.

A CONSIDERABLE amount of interest has been manifested in the margarine industry in New South Wales during the winter just ending. The reason for this sudden activity on the part of the butter merchants, agents, and producers is due to the fact that margarine mixtures have taken the place of second quality butters to a very considerable extent during the winter months, both for sale in Sydney and for sale to ships trading from the port. In fact, what would be known as pastry butter is not now required for pastry purposes, because a cleaner tasting fat can be obtained in the shape of margarine than that which was accustomed to be purchased as pastry butter, this latter being usually old rancid butter not good enough for table use.

That this state of competition between butter and margarine would eventually be reached in New South Wales was evident six or seven years ago to those who were in a position to form an opinion.

In 1903 I addressed several meetings at which this matter was discussed, because at that time a Dairy Bill was before Parliament which provided among other things clauses relating to the control of the manufacture and sale of margarine. Wherever I addressed meetings on dairy matters questions were asked regarding the Dairy Bill, and I always advised farmers to endeavour to get their representatives alive to the necessity of having the margarine clauses of the Act passed, no matter what became of the other sections. The Bill was read a first time and then dropped, mainly because it contained clauses compelling the grading of cream and butter. Since then there has been no special dairy legislation, and hence no special margarine legislation, but the Pure Foods Act which has just come into force contains some valuable clauses for the control of the margarine industry. Unfortunately, these clauses do not govern the manufacture of margarine thoroughly, and there does not appear to be any power to compel such items as the registration of margarine factories, or the adding to margarine in the process of manufacture of any tell-tale or ear-marking substances which would enable the chemist to more easily detect the presence of margarine in butter. So much for the question of legislation, &c. Let us now hark back to the technical features of our subject.

The first question which presents itself is how and when did the manufacture of margarine originate, and what is it?

The manufacture of margarine originated in the time of Napoleon, who, requiring cheap butter for his army inquired if something could not be done to make it more plentiful, the result being that investigations were made into the composition of butter fat and animal fat and chemists set about making a composition of the latter to represent butter.

Mr. Mege was the inventor of margarine. He found after experiments that two constituents of beef fat resembled butter fat very much. He therefore separated the stearine from the oleine and the margarine of beef fat and used the two latter constituents, now commonly called oleo-margarine, for the purpose of adding more fat to the milk before churning so as to increase the quantity of butter manufactured.

Margarine, sometimes called oleo-margarine, might therefore be defined as an imitation of butter consisting mainly of animal fats other than butter fat.

It was originally manufactured chiefly from beef fat, but the refining of oils (animal and vegetable) has been so improved, and the technique of margarine manufactured has been so perfected, that in some countries a margarine may now be made containing animal and vegetable oils which will have practically the same chemical constituents as butter.

Let us have a look at the composition of butter and of margarine in order to fully understand what margarine is.

Butter fat, the chief constituent of butter, has been described as a mixture of glycerides, these glycerides being combinations of glyceryl with fatty acids. Some of these fatty acids are volatile and soluble, but the greater proportion are insoluble and non-volatile. The insoluble glycerides found in butter are Oleine, Stearine, and Palmitine.

The volatile fatty acids, namely, Butyric and Caproic, help to distinguish butter fat from all other animal fats, these being known as the volatile fatty acids of butter. They form about 6·7 per cent. of the total fatty acids in butter, the remaining 93·3 per cent. being both non-volatile and insoluble fatty acids.

Now, margarine, according to Blyth, consists of the following:—

Water ...	12·01 per cent.	Butyrine, Caproine, and Capryline.	0·26 per cent.
Palmatine ...	18·31 „		
Stearine ...	38·50 „	Caseine	0·74 „
Oleine ...	24·95 „	Salts	5·23 „

It is thus seen that the volatile fatty acids in margarine form an extremely small proportion, they being represented by the Butyrine, Caproine, and Capryline.

The best mixtures sell at nearly as high a price as pure butter; but there are lower qualities of margarine, which are mostly made from cheap animal fats and vegetable oils; and these inferior qualities are sold at prices as low as 4d. a pound in England.

Different companies use different products in the manufacture of margarine; but beef fat, best lard, and at least one vegetable oil are the usual ingredients. The composition of a margarine depends not only on the quality required, but on the source of manufacture; and margarine made in Germany, Denmark, Sweden, Belgium, and Austria must all contain at least ten parts by weight of sesame oil; it being compulsory under the laws of those countries to use this oil in the process of manufacture, so that the analyst may be enabled more easily to detect the addition of margarine to butter.

Margarine Legislation.

As the manufacture of margarine improved, so its competition with butter became more strenuous and weighty; and were it not that special legislation has been adopted in every dairying country to protect the manufacturers and producers of pure butter, no doubt, by now, the illegitimate article would have, practically speaking, taken the place of butter, except in the houses of the rich. Had the manufacturers of margarine at the very beginning not attempted to make a substance in appearance resembling butter, they would have possibly by now accustomed the public taste to the appearance of margarine, and people would eat it, knowing it for what it was, without any feeling of shyness, or without any sentiment whatever; but, from the very first, all efforts have been directed towards presenting to the public an article which would be easily mistaken for butter, and hence when margarine is consumed it is, in most cases, eaten under the impression that butter is being taken.

At first the detection of margarine in butter was difficult, but a thorough study of the question resulted in a fairly easy method of determining the amount of volatile fatty acids being perfected. This has become known as the Reichert-Woolny system. Similar investigations, however, into the composition of butter clearly demonstrated that butter often varies in its composition very considerably, and that under certain conditions and seasons of the year butter is produced which, if judged on its percentage of volatile fatty acids only, would be declared as a margarine mixture.

Standard.

For this reason it is impossible to adopt a high standard, and therefore small quantities of margarine may be added to the butter without fear of detection in this way. This was the reason that the countries indicated—namely, Belgium, Germany, Denmark, Sweden, and Austria—compelled margarine manufacturers to add a tell-tale substance such as sesame oil in the manufacture of margarine. In addition, some countries (Belgium) have also compelled manufacturers to add starch, and others (Hungary) to add a colouring substance known as dimethylaminoazobenzene.

It is also forbidden to add more than a certain percentage of butter fat to margarine in the manufacture, and this is one of the items of legislation prevailing in England. The reason for this is to prevent the manufacture of a mixture which would contain, say, 40 per cent. of margarine and 60 per cent. of butter, though of course this is still being done; and the whole difficulty is, even after the inspector has taken the samples, to get chemists to agree that the sample taken is an adulterated butter.

The manufacture of margarine and butter in the same place is also one of the clauses adopted in many countries for the controlling of the margarine industry.

The registration of margarine factories, and the attaching of certain names over all places where margarine is manufactured or sold, is another means used in some countries for the better government of the industry.

The United States prevents the addition of colouring matter to margarine which is made for local sale; and it also exacts a tax on all margarine manufactured, whether for local sale or for export.

The Detection of Margarine in Butter.

The refining and blending of fats has become so advanced that the detection of margarine in butter has become very difficult. In his evidence before the Select Committee in the House of Commons, 1906, Dr. J. Lewkowitsch, M.A.F.I.C., Ph.D., an eminent chemist and author, stated that even the addition of sesame oil to margarine would not prevent deception, because it is possible to add something in the shape of a colouring matter which would prevent sesame oil giving its characteristic reaction.

Various other objections are raised to the addition of sesame oil to margarine, one of which is that the supply of sesame oil of a quality sufficiently good for the manufacture of a high-class margarine would be insufficient if all countries compelled the adoption of this means of detection. Some of the qualities of sesame oil, especially that made in China and Africa, are absolutely obnoxious to the taste, and hence it is impossible to use them in the manufacture of a good class margarine. The best is what is known as Jaffa oil, which is an expensive item.

Starch.

As a set-off against the use of sesame oil as an indicator of margarine, manufacturers on the whole recommended potato starch when giving evidence before the Select Committee above referred to. An objection, however, to the use of starch is that it is such a common article of commerce, and is used so much for household purposes, that traces of it might readily get into cream and hence into butter, and, therefore, a pure butter might be condemned as margarine, having given a reaction showing the presence of starch.

In presenting their report, the Select Committee referred to these ear-marking substances as follows :—

"One of the chief difficulties in checking the adulteration of butter under the existing law is that where the adulteration of butter with fat not derived from milk is carried out scientifically, it is extremely difficult for analysts to certify to the adulteration.

"The suggestion has been made that the analytical difficulty in the way of detecting the adulteration of butter with margarine might be surmounted by requiring all margarine manufactured in the United Kingdom, or imported from abroad, to contain a certain percentage of some ear-marking substance.

"If this suggestion applies only to the article recognised in the trade as margarine it is futile, as such margarine is not generally used at the present time to adulterate butter. Other fats and oils are more generally used for this purpose.

"If, on the other hand, the meaning of the word 'margarine' is extended so as to include all fats and oils which are capable of being used as adulterants

of butter, then the objection arises that many fats and oils capable of being used for adulteration of butter are used by many industries not connected with butter.

"Sesame oil and starch were the two ear-marking substances recommended to the Committee. Objections were urged against the use of both of these substances."

Prevention of the addition of colouring matter to Margarine.

If colouring matter is not allowed in the manufacture of margarine, then its appearance will not resemble butter. This is one of the features in the margarine laws of most of the States of America, but it appears that the United States Federal law does not compel colouring matter to be omitted. Lack of colouring matter would undoubtedly prevent the sale of all margarine as butter, but it will not prevent the sale of a mixture of 70 per cent. margarine and 30 per cent. butter as pure butter, for this reason: that if a butter of deep colour is mixed with this proportion of margarine, the colour of the mixture will be quite yellow enough to have all the appearance of a pure butter.

The addition of special colouring matter to Margarine.

Several attempts have been made by butter-producers to compel margarine manufacturers to add a distinct colouring matter, so that margarine would not in any way resemble butter, but it seems improbable that the public shall now at this stage be forced to eat margarine of, say, a pink or a red colour, hence legislation with this object in view does not appear very probable.

The Volatile Fatty Acids, or Reichert-Woolny figure.

This is really the best means of detecting pure butter from a mixture of margarine and butter, but in order to be able to sustain a prosecution successfully, either one of two things is necessary, namely, that the proportion of margarine in the butter shall be high, something in the neighbourhood of 40 per cent., or over; or that the source of the manufacture of the butter shall be definitely known.

In the latter case it would be possible to obtain a sample of pure butter manufactured in the factory referred to at that time for the purpose of making analytical comparison between that and the article sold as representing butter from that district, and hence the analyst could swear that the article was adulterated or otherwise.

With the object of ascertaining the exact percentage of volatile fatty acids in the butter made in Holland throughout the various seasons of the year a number of chemical control stations have been established, and the butter from each factory is examined regularly, for each month in the year, so that any considerable departure from these standards may be readily classed as adulteration. The system, however, is a very expensive one, and is not of great utility when the butter has been exported. Its great use lies in the fact that the Government allows the factories whose butters are so examined

to use an official label guaranteeing the purity of their butter, and any butter not so guaranteed, if exported from Holland, is looked upon with suspicion.

Another matter, however, has cropped up to interfere with the value of this test, namely, what we know as the Reichert-Woolny figure, and it is this: A substance is now manufactured and sold to margarine manufacturers for the purpose of supplying the deficiency of volatile fatty acids in margarine; and of course this will, if carried on extensively, neutralise the value of the Reichert-Woolny method of detection.

In fact, the whole question of butter adulteration is at the present time a battle between chemists. The chemists representing the manufacturers are probably better paid and have more time to devote to these subjects than the official analysts, and hence no sooner is one means of detection discovered than the manufacturing chemists alter their methods and utilise some means of making useless the method of detection which the official analyst has discovered.

Control of the Manufacture.

It seems to be boiled down to this, that if the sale of margarine is to be controlled successfully the manufacture of this commodity must be thoroughly supervised, and among other things it appears the following will be required:—

1. The registration of all places where margarine or other butter substitutes are made.
2. The prevention of the manufacture of butter and margarine on the same premises.
3. The registration of all butter factories, and prevention of such factories having on their premises or utilising in any way those foreign fats and oils (whether animal or vegetable) which are utilised in the manufacture of butter substitute.
4. The prevention of any fancy names for margarine when used for sale, such as "Butterine," "Buttafat," &c.
5. It may also be advisable to compel the addition of sesame oil or starch in the manufacture of margarine; and
6. It may be advisable to provide a power to review the books, showing where the consignments of margarine are sent.

THIS season the area under wheat in New South Wales is estimated at 2,240,408 acres, which shows an increase of 251,000 acres as compared with last year.

The prospects of a good yield are highly favourable.

For the guidance of those who have not had the advantage of prolonged experience in the harvesting of wheat for grain and for hay, a number of our most successful wheat-growers, and the officers of the Department of Agriculture best fitted to advise in such matters, have collaborated in the preparation of the following notes.

In going carefully through all the views expressed as to the various operations of harvesting, it will be noted that there is a considerable diversity of opinion. It must be remembered, however, that the wheat districts embrace a tremendous range of local conditions. An attempt has been made, under the guidance of Mr. G. L. Sutton, Wheat Experimentalist, to arrange the information as nearly as possible in accordance with fairly well-defined districts, and it is thought wheat-growers by selecting, carefully reviewing, and digesting the advice emanating from farms subject to climatic and local conditions similar to their own, may be able to derive useful information. It is to be hoped, however, that the whole series of notes will be read and discussed by all concerned in the safe handling of what promises to be a magnificent harvest. Special attention is directed to the notes on conservation of some of the abundant growth of grass in the shape of hay or silage.

It is to be sincerely hoped that no wheat-grower will be so regardless of his own interests and of the interests of his neighbours and of the State, to **neglect any precautions calculated to diminish the risk of loss of standing crop by fire.** Now is the time, while everything is still green, to lay out firebreaks and burn rubbish that serves as tinder in summer; now is the time to organise the bush-fire brigade, and to drill together a bit, so that on emergency every man's services will be direct and effective.

Riverina District.

Mr. Anthony Brunskill, of Allonby, Wagga Wagga, says:—"The system I have always adopted when harvesting for hay is as follows:—

"Firstly, I always cut a large proportion when green, thus assuring a good sample in all seasons.

"Then, after stooking same *well* in a thoroughly weather-proof manner, I commence stacking, on a foundation of wood, to keep the damp from injuring the hay in the bottom of the stack; also, a drain should be dug to carry away all water that will run off the stack. After the stacks are thatched, they should be left until a fair price can be obtained.

"When the grain begins to harden, I continue cutting with the reaper and binder, and stack for threshing. I find that the extra labour required for stacking and threshing, as against stripping, is amply made up for by the straw thus obtained.

Harvesting at Allonby.

"By this time the wheat is hard and fit to strip, so I finish my harvesting operations with strippers.

"By cutting a proportion of wheat for threshing before stripping can be commenced, a large amount of risk, in the shape of fire and storms, is done away with."

Temora District.

Mr. Wyatt de Little, of Narnoo Mia, Temora, writes:—"I have had experience in three methods, viz., Stripping and Winnowing, Binding and Threshing, and Stripping with the Harvester.

Stripping and Winnowing.

"This method I consider is now out of date, except in cases where the grower's capital is limited; then it may be done until circumstances enable him to purchase up-to-date machinery. Still, I think a harvester at £100,

on terms, would be cheaper than a second-hand stripper and winnower at £50 over a period of three years.

"The principal objections to this method are—

"1. Where a grower has not a family to help him, the cost of winnower labour and the many dodges the labourer is up to to delay and make the work easier.

"2. Loss of grain through the winnower. See any chaff heap after autumn rains.

"3. Generally inferior sample of wheat.

"The cost of this method for eleven years, 1896 to 1907, on crops, average 10 bushels per acre, was 5s. per acre, not including cost of cornsacks or supervision.

Cutting, Binding, and Threshing.

"When droughts are taken into consideration, this is no doubt the best method, if it could be done more cheaply. My experience in the few trials made was that the harvesting took much longer, was more costly, and the value of the straw saved did not compensate, as when the accounts were made up the extra cost of getting in the grain by this method placed the straw at about 17s. 6d. per ton in the stack. Then there would be the cost of thatching, interest on the outlay, chaffing and bagging, and cartage. By the time it reached the railway it would cost over £2 a ton, and if all wheat-growers threshed and saved straw, the straw chaffed would never leave a profit. But this method would become more general if there were threshing plants available, as one cannot get away from the fact that a stack of good straw is a valuable asset to a farmer who has a number of stock. Still, for economy and speed, this method cannot be compared with the use of the harvester

Stripping with Harvester.

"This latter method of harvesting should be done at a cost of under 2s. per acre—that is, allowing two men at 8s. a day and four horses to one harvester. A harvester makes a far better sample, and the loss of grain is not so great as with the stripper and winnower, and very little, if any, greater than the loss through binding, stooking, and carting in sheaves.

"Before harvesting, tracks not less than ½ chain wide should be cut through the crops, (1) to obtain hay and (2) to make firebreaks. I prefer them 1 chain wide. Poles should be placed where the wheat is to be stacked, and the bags stacked in single rows five high; but it is better to cart wheat out of the paddock, as a loss of weight equal to about 4 lb. per bag (new) takes place if they are left exposed to the sun and wind for a few weeks."

Koorawatha.

Mr. J. Freebairn, of Koorawatha, writes:—"Our usual method of dealing with the crop is, when it is fit to cut for hay, start into it with a binder and cut a fair amount as hay—enough for home consumption, and a fair amount besides, say, 100 tons. This we consider a good asset, and it reduces

the quantity to be dealt with otherwise. Then, as soon as it is fit to strip, we go into it with harvesters, and keep them going, with change of teams, from early morning until sundown, with just time enough for drivers to eat their dinner. We keep a man to attend to the horses and take the changes of teams to the paddocks, so there is very little time lost.

"We have cut a good deal from threshing in former years, with a good deal of success; but, considering all things, we consider the harvester the best way to handle crops in this district, except in cases where a big lot of heavy crop is standing with a tendency to go down, then we think a portion should be cut and stooked. Even if there is not time or strength to stack it before the stripping starts, it is safer in the stooks than standing, and can be stacked and threshed when the stripping is finished.

"There will always be a loss of grain through weather conditions, and some is lost by the machinery in use; but if every farmer was ready for his crop as soon as his crop is ready for him, and kept the necessary strength to take it off quickly, less grain would be lost."

Young District.

Mr. Crawford Greene, Manager of Iandra Station, upon which nearly 20,000 acres of wheat is grown, has furnished, through Mr. Inspector Reynolds, full details of the methods so successfully practised on Iandra. Mr. Greene adds that when a paddock is not to be immediately cultivated again, the dropped grain will grow a 10-bushel crop without any expense of ploughing, sowing, cultivating, harrowing, manure, or seed. Also, if the crop thus procured is not desired for grain, it will carry up to ten sheep to the acre for a considerable time. Then, again, if the paddock is not going out of cultivation, large numbers of sheep can be fattened, without ill effect, on the fallen husks and grain between harvesting and ploughing.

Cowra District.

Mr. E. S. Twigg, of Broula, writes:—"*Re* methods of harvesting wheat, a farmer should fallow one-third of the total ground he intends to sow. Start ploughing stubble ground middle of March, using soft centre mouldboards for all red, sticky ground. I do not believe in any sort of disc ploughs.

"If ground is in good ploughing order, roll with 10 feet long by 18 inches diameter log-roller immediately after the plough. Drill follows, with 40 to 50 lb. superphosphate mixed with seed. Stretch a chain across behind the drill, to partly fill up the little furrows made by the drill. If possible, I would like to have the ground ploughed, rolled, and sown the same day. This log-rolling after the plough is the most important business in the sowing season, and one almost entirely left undone in New South Wales. When

the crop gets well out of the ground, roll again with this roller. It packs the little lumps of soil tight to the roots, whereby the crop gets the benefit of all the soil. This log-roller acts like harrowing, besides all the other good things. It also leaves the ground nice for harvesting operations. I try to finish all sowing by end of May, but on the black flats sowing may extend to the end of June.

"Start cutting wheat for hay when the head is in flower; stook it well in round, fairly-sized stooks. Always put the sheaves down with a bump on the ground, as they stand the windy weather better and are less likely to blow down. Start carting into the stack as soon as you can get the straw to crack when bent quickly; if it will not crack, the hay will not keep.

"Algerian oats should always be cut with the reaper and binder, and threshed, because the straw is too valuable to waste.

"Start cutting wheat for grain as soon as possible with the reaper and binder, and continue same until ripe enough for harvester.

"Always be careful to stook it well, as this wheat must stand in the stooks for threshing until the harvesters have finished stripping.

"When the wheat is dead-ripe, keep the harvesters going as regularly as possible. The machines should be worked with two sets of horses, and the spare teams should cart the wheat from the paddocks to the barn so each day's harvest is safely stored by nightfall, the morning teams in the harvesters carting in the afternoon, and *vice versa*.

"Threshing for finish should be done straight out of the stooks. When well stooked, it takes a lot of rain to damage the wheat. I always think my crop secured when it is stooked; and though threshing is more expensive than using the harvester, in the run of a few years you find that you are well repaid by adoption of the cutting and threshing method, which enables you to secure your crop as soon as possible. The straw has always paid in a lot more money than the threshing cost me. The straw should be well built and thatched, and it will stand years without the slightest damage. Even when not thatched it stands well.

"Threshing straight out of the stooks saves stacking. In my opinion wheat, even when stacked, if not thatched, will take more harm than in well-built stooks.

"A 5-feet drum thresher is a good kind to use, and five little two-horse waggons is the ideal for carting the stooks to the thresher, but, of course, any vehicles will do. In this way, 180 to 300 4-bushel bags of wheat can be turned out per day, and of Algerian oats 250 to 400 bags.

"The 5-feet drum thresher is worked with an 8 h.-p. steam engine. The latter should be a traction engine, as portables are behind the times. An 8 h.-p. traction engine will draw 150 4-bushel bags on two waggons off the stubble ground to railway station in dry weather.

"My advice to farmers who are not yet in a position to have sufficient plant of their own, is to join in with their neighbours and help each other with the threshing."

Harvest Hints.

R. W. PEACOCK, Manager, Bathurst Experiment Farm.

The aim of the farmer should be to harvest his crop expeditiously and economically. Ripening wheats do not study the convenience of the grower. The grower must look after his own interests and be prepared to carry out the work expeditiously. Serious losses may follow unpreparedness. *Wheats should be harvested as soon as possible after they are ready.* Ripe crops may be damaged or totally destroyed by forces over which the farmer may have only partial or no control. Every day they stand after they are fit to cut increases the probability of loss.

Risks.

A ripe crop may be destroyed by fire. To minimise the risk from such, narrow strips around the paddocks should be cut for hay, and the land ploughed to act as fire-breaks should never be neglected upon areas adjacent to railway lines. After a bountiful spring in many places there are frequently large quantities of inflammable herbage and grasses surrounding the fields in the summer. Narrow tongues of such may act as a fuse to light fields a considerable distance away from the source of ignition. These should be chipped across here and there to prevent a fire travelling. The judicious firing of the drying grass or herbage during favourable weather, might be followed in some instances to advantage. Effective fire-breaks may be made by freely stocking certain areas throughout the spring. Large quantities of dry grass should not be tolerated around the homestead. All stacks as soon as possible after being built should be ploughed around and all litter carried away. Safety matches only should be used on the farm.

It may be partially threshed whilst standing by severe wind storms; to provide in some measure against this, varieties are grown which hold their grain firmly.

It may be seriously damaged by a hail-storm. Severe storms with rain and wind may beat it down beyond the reach of harvesting machinery.

Continuous rains may prevent harvesting and cause the grain to sprout in the ear.

Showers bleach ripe grain and reduce its value. Birds get more than their reasonable share from over-ripe grain.

To reduce the probability of such losses, foresight, intelligence, and expedition are necessary.

Methods of Harvesting.

The two principal methods of harvesting are cutting with a string binder, stooking, carting, stacking, and threshing, and stripping the heads from the standing crop and threshing at the same time by the same machine.

By the second method a stripper and winnower and also what is termed a complete harvester are used.

A stripper differs from a combined harvester in that it only strips and threshes, the winnowing and cleaning being done by a separate machine.

The combined harvester strips, threshes, and cleans, and fills the bag, leaving the grain ready for market as it travels in the field.

The practicability of either method will be influenced by the humidity of the climate of a district at harvest time, the conformation of the country, the value of the straw, available machinery, and cost.

In the Tableland districts, where heavy dews and frequent showers are experienced, the binder and thresher are almost universally used.

The stripper and harvester have been evolved for the drier districts. The harvester is only suited for comparatively level country. Upon undulating country it is difficult to regulate the pace for the cleaning machinery and keep the sieves in the desired position. If such is not done, considerable waste is sure to occur. The stripper is more suitable than the harvester upon such country.

Upon favourable country with a suitable climate the two methods may be advantageously used; upon large or even moderate sized farms it is imperative to harvest as much as possible with the same man, team, and machines. To ensure this, harvest time should be prolonged within reasonably safe limits.

The following is recommended:—A man with team and binder should commence to cut a portion of the crop for hay as soon as the crop is well in bloom. As soon as the last shades of green are passing from the paddock, he should cut for grain and continue until ripe enough to strip; with an additional horse the same man could continue harvesting with stripper or harvester.

The cost of cutting, stooking, carting, stacking, thatching, and threshing is greatly in excess of harvesting by stripper or complete harvester. Against the extra cost may be placed reduction of risk from fire, storms, birds, &c., value of straw, better quality grain, less waste, and cleaner paddocks.

The later harvesting by stripper or harvester allows the weed seeds to mature, they are not taken off the field as with the binder, but are, in the case of the harvester, sown broadcast instead.

Nevertheless, the crucial points in wheat-culture are the cost of production and the retention of fertility. The latter, unfortunately, is too frequently overlooked. The stripper and harvester have rendered wheat-growing profitable under conditions where the more expensive methods would have led to loss. There is much to be said in favour of a judicious mixture of the two methods. Each grower should ascertain what it costs him to produce a bushel of wheat. Many are satisfied with small crops and small cost of production. Large crops and large cost of production may result in a cheaper bushel.

Arranging for Harvest.

To make adequate arrangements for the harvest a farmer should have some idea of what a man, a team, and a machine should do under normal conditions. When a reasonable proportion of the wheat crop is cut for hay and judgment used in the sowing of varieties which do not mature at the same time, a binder should deal with 200 acres, cutting on the average from 8 to 10 acres per day.

The period at which a crop is fit to cut for grain and when it is too ripe for the binder varies with the conditions, and ranges from a week to a fortnight. During the latter part of this period the team should do the most of its work in the morning and evening; the part of the day when most grain is shed whilst cutting is during the afternoon.

If a change of horses and men can be arranged, a binder may be made to cut fully one-third more than with only one set of horses.

Four men, three horses, and a trolly should be sufficient for the stooking, carting, and stacking of each 200 acres.

A stripper or harvester should strip from 6 to 10 acres per day. Four horses are required. With the stripper two men are required to do the cleaning with the winnower. With the harvester only one man is required besides the driver to look after the bags. These machines cannot be worked effectively whilst the grain is damp from rain or dews, on account of the difficulty in stripping and threshing the tough wheat and the danger of the damp grain heating in the bags.

Harvesting for Hay.

Generally speaking, wheat is cut for hay with a binder. It should be cut whilst in full bloom; at this stage it has practically attained its full height, has not begun to turn yellow at the bottom, and will contain a greater amount of digestible matter than if allowed to get riper. The practice of waiting for grain before making into hay is a mistaken one. Such leads to loss of both colour, weight, and digestibility. If the crop is green and flaggy very small sheaves should be made. Large sheaves may go brown in the centre at the bands.

Only the best quality twine should be used. Faulty twine is vexatious and leads to considerable loss of time in hand-binding sheaves.

Small stooks of about a dozen sheaves dry readily. Sufficient time for drying should be allowed before carting. Under normal conditions upon the Tablelands ten days to a fortnight are required. This varies very much with the conditions. To test its fitness a handful should be pulled from the middle of a central sheaf of the stook and twisted short. If it breaks and appears brittle it is fit to put into even large stacks; if it is very tough it requires more time. Under moist conditions it may be wise to cart the outside sheaves from the stook first, leaving the central sheaves to get an extra day's weather. Hay may be carted greener into small narrow stacks than into large wide ones. Considerable loss of value may result by stacking too soon.

Harvesting for Grain.

As before stated, reaping may commence as the last shade of green is passing away. Under favourable conditions ripening may continue for a short time after being cut, the grain being built up by transference of material from the straw. Under very dry conditions this is limited. Two widths of the binder should be cut for hay off the outside of each piece—to be cut separately. This prevents the breaking down of the ripe straw which does not rise quickly enough to be picked up by the binder upon the return when cut for grain. When the crop is green it rises and very little waste occurs if the binder is set low. When a considerable area has to be harvested it is wise to commence as soon as possible. If the crop ripens too quickly and the grain is well filled, grain may be knocked out in the cutting. The greatest loss occurs during the afternoon, and, when practicable, it should be cut before mid-day and during the evening.

The binder for ripe crops should always be fitted with a sheaf carrier, as such breaks the fall of the sheaf and prevents waste. In light crops loose material is also kept together by using the carrier. By its use the labour of stooking is considerably reduced.

Stooking.

The methods adopted vary with the climatic conditions. In districts where fine weather conditions during harvest are the rule very little trouble is taken, and twelve or fifteen sheaves are put together in round stooks in such a way as to withstand the winds only.

In districts where wet harvests are the rule considerable skill is required in building stooks to shed the rain, to dry quickly after being wetted, and to withstand winds.

Stooking, whenever practicable, should be done whilst the straw is tough in the morning to prevent waste in handling. *Ripe wheat should not be handled during the heat of the day as the grain is more liable to shed then.* In stooking, two sheaves should be handled at once, each sheaf is grasped about a foot from the ears and stood firmly on the ground, leaning towards each other at the top, and the short side of the sheaf towards the centre. About three pairs should stand firmly upon their own bases. Two additional pairs at each end should lean towards the central pairs. A single sheaf should be placed at each end. This would allow for sixteen sheaves upon the ground. Two sheaves should be used as caps. The butts are placed in the centre and pressed together to interlock them. A good handful of straw upon each side of each capping sheaf is bent down from the bands to prevent the winds from blowing the cap off.

The number of sheaves in such stooks will depend upon the length of the sheaves, as no more should be placed in the base than can be reasonably covered by the two capping sheaves. Such stooks, if properly built, will turn considerable rain and dry readily. As they are only

two sheaves wide they may be blown over. To overcome this, buttresses should be started upon either side at the centre and built as the original stook, and covered by two capping sheaves as before described. These stooks are built in the form of a cross and would withstand considerable wind.

Stacking.

Wheat should not be stacked whilst damp. When cut on the green side it would require a full week in the field upon the Tablelands in favourable weather.

The condition of the crop when cut and the weather are so variable that no rule can be laid down. If slightly damp when stacked it should remain in the stack a few months before threshing, or otherwise it will be difficult to thresh and grain wasted. Round stacks are more easily built than oblong ones. One 8 to 10 yards in diameter would hold, approximately, 500 bushels of wheat from a fair average crop, if carried to a reasonable height. Considerable judgment and experience are required to fit a certain amount of wheat into a stack of a certain size.

If stacks are to remain for a considerable period before threshing, provision should be made to keep the damp from ascending from the ground or storm water from running under. A good practice is to cut a drain about 6 inches deep and 2 feet wide just outside the ring upon which the stack is to be placed, the earth to be thrown into the centre. Upon this, old dry straw should be placed to the depth of about a foot. If straw is not obtainable, bushes make a satisfactory non-conductor of moisture. Where such provision cannot be made the stack should be commenced by forming a round stook in the centre and building outwards, by only placing the butts of the sheaves upon the ground, keeping the heads off by resting on the butts of the other sheaves.

With round stacks the wedge shape of the sheaves allows them to fit admirably. The outside ring of sheaves should be packed neatly and tightly. Those of the inner rings should lap over the outside sheaves about to the bands. All loose material should be forked to the middle before commencing another tier.

The middle of the stack should be kept reasonably full until the wall is built. The last few tiers of the body of the stack should be kept extra full in the middle before commencing the roof. The last tier of the body should project 4 inches to allow a slight projection for the water to fall clear of the wall. The roof should be built at such an angle that it would settle to about 45 degrees. The desired angle and evenness of roof can be obtained by using the bevel of the butt of the sheaf. As the stack is being built any sheaves out of position could be knocked into shape by a board about 1 foot square, fitted with a handle.

Roofs may be put on stacks in such a way as to turn the rain without thatching. Considerable skill is required, and it takes much longer. From a labour point of view it is almost as economical to thatch.

When thatch is not available the roof should be commenced by keeping the middle very full; each tier of sheaves should be started in the centre

and built outwards in the same way as explained in commencing the stack by keeping the ears off the ground. Two stacks should be built together for convenience in threshing; the eaves should be about 15 feet apart for the barn works to be placed between. More than two should not be built together for fear of fire.

Thatching.

When stacks are being built, tarpaulins should be available to cover them, also the loads during rains. Thatching may often be fitted in during damp weather when the crop is not fit to cart. When tarpaulins are depended upon for any length of time the cost for such may be considerable.

Wheat straw is generally used for thatch. Thatch-making machines have not come into favour. It is mostly prepared by hand. It is difficult to teach how to thatch from written descriptions; in fact, this applies to all of the above, and much has to be learned by experience.

A piece of land with a smooth surface should be chosen on which to prepare the straw. The straw is spread out evenly upon a base of about 12 x 12 feet, the straws, as much as possible, being laid parallel. When about 1 foot thick, water is spread upon it by a watering can or thrown in thin sheets from buckets. It is then beaten down with the back of a fork.

Another layer is added about 9 inches thick, and again watered and beaten. Care should be taken that the centre is not raised, but the whole kept on a level plane so as to retain the water within itself. Successive layers are put on until it is too high to apply the straw and water conveniently.

If required, other lots could be treated in the same way. The main consideration is to get the whole of the straw wetted and softened without an undue waste of water. Dry patches are very unsatisfactory. It is better to let it soak overnight or for several hours before preparing for thatch.

A level piece of land is chosen alongside upon which to draw the straw. All weeds and rubbish or stubble are cut off so as not to interfere with the rigidity of the prepared pieces. A piece of rope with a loop on one end, or, preferably, a strap about 6 feet long, is placed adjacent on the ground. Straw is drawn by the hands from the wetted heap and placed upon the ground. Other handfuls are placed alongside, the grasped ends being placed towards and away from the drawer alternately. When about twelve or fifteen pieces are pulled and laid down they are worked into a flat shingle-like piece, colloquially termed a yellum, about 3 inches thick, and 15 inches wide, and about 3 feet long, the length depending upon the length of the straw. The operator kneeling, the ends of the yellum are neatly trimmed with the fingers. When rising from the knees the hands are placed on either side of the yellum, which is grasped firmly and placed upon the strap or rope, one side being about 3 inches from the end of the loop.

If the yellum does not withstand the pressure in handling, it is not properly made. The next yellum is made and placed across the other on the rope at about the same angle as the strokes of the Roman figure X. This ensures the individuality of each yellum when tied together; about six are placed in each bundle; the end of the rope is placed through the loop and pulled tightly and secured. It is then ready to be carried up the ladder or thrown up with a pitch-fork.

Before commencing to thatch, the roof should be evened, any hollow should be filled with the same material or straw and apex completed. In rectangular stacks a long ladder is placed about 2 feet from the right-hand end of the stack if the thatcher is right-handed.

Thatching pegs should have been kept over from previous years or prepared during the winter. They should be about 4 feet long for the loose ends of stacks and tops, and about 3 feet for tighter portions. A fork or portion of a limb should be left at the top to prevent the twine from slipping off; they should be neatly pointed at the large end. Basket willows are worth growing where practicable to provide these. Twine should be in readiness, and if to be left for several years it is preferable to use tarred twine.

After placing the ladder to lay flat upon the angle of roof, about 2½ feet, or twice the width of a yellum, from the end, two strong sticks are driven into the stack to the left of the ladder upon which to hold the yellums.

Before laying on the thatch drive pegs, to which the twine securing the first section of thatch can be tied, into the end of the stack. The first peg is to be placed half the length of a yellum from the eave, and the others are to be the same distance apart.

Commence to thatch by placing one of the yellums on the end of the roof, care being taken to give sufficient projection to the thatch to turn the rain from the wall. If the eave is not sufficiently pronounced, some of the material of the stack may be doubled back upon itself, or a small bundle of straw pegged on to make good the deficiency. Another yellum is then placed alongside the first. The inner sides of the two yellums should be carefully worked together so that the joint will not be apparent. Any loose straws or a faulty joint may allow the rains to enter.

A peg is driven into the thatch half the length of a yellum from the eave, and about 3 inches from the side near the ladder; this peg should be placed with the point directed upwards, so that it will not lead the rain into the stack. To fasten these yellums on, the twine is tied on to the first peg in the end of the stack and brought across the thatch to the first peg in the roof, to which it is secured by two half hitches; the peg is then driven home to tighten the twine upon the thatch. Another course of thatch is now put on, by placing two or more yellums in the same way as, and above, the first course. These are placed so that the lower ends will just cover the string upon the first course. A second peg is then partly driven into the roof, at the same distance from the eave as the second peg in the end of the stack. This second course of thatch is then tied on by bringing the

twine from the first peg in the roof to the second peg in the end of the stack, and thence to the second peg in the roof, which can then be driven home. Other courses are placed and tied on the stack in the same way until the top is reached. The top end of the last course should be placed high enough so that the corresponding one on the other side fits tightly against it to exclude the rain. The pegs for the top row are driven downwards into the stack to ensure sufficient hold. When the first section is completed the ladder is moved about 2 feet 6 inches along the roof, care being taken not to disturb the thatch. Another section of thatch is put on by placing the yellums as before described, tying the first, middle and top courses only, or if the roof is long, the first, top and two courses in the middle. These are tied on by bringing twine from the pegs in the previous section to corresponding pegs in the thatch that is being put on. When each course of thatch is put on, it should be smoothed down, and loose straws removed by beating it with a pliable stick.

When the side of stack is completed all but the last course, the ladder is put to the right upon the thatch, and the last course put on and tied as explained for the first. When the thatching is finished only the top string and the diagonal ones on the end courses will be exposed.

The operator works back-handed, and must take care not to injure the thatch under the ladder. The ladder may also be stood against the end of the stack to put on the last course, it being removed further up as required. The other side should be thatched in the same way.

To improve the appearance, the thatch projecting over the eaves could be neatly trimmed with shears.

Round stacks may be thatched in much the same manner, excepting that the courses taper to the apex. The thatch may be prepared with the top of the yellum somewhat narrower than the bottom. The principal considerations are to exclude the rain, and tie on so that winds will not blow it off. This can only be done by preparing well the straw, giving strict attention to the joints, the placing of the pegs and tying. In loose stacks longer pegs are required.

Harvest Time.

Report by Inspector and Instructor Mark H. Reynolds on Methods of harvesting Hay and Grain in the Central Western Division of the State.

In placing before *Gazette* readers the methods of harvesting adopted by Central and Western farmers, I have endeavoured to supply information which may be of assistance to the beginner, and also to place before established farmers methods in vogue in their district. To attain this

object I have supplemented my observations and experience with notes obtained from a few successful farmers located in different portions of the West. Amongst others, the following gentlemen willingly answered a number of questions put to them:—Messrs. C. Greene, Iandra; J. Young (Young and Ralli), Young; T. Bragg, Mungeribar; J. Wren, Maryvale; D. Ross, Comabella; C. J. Maslin, Grenfell; H. Caughey, Mudgee; M. Brown, Terrabella; J. Clark, Dapper.

Table A refers to the average time of starting operations for haymaking, cutting for threshing, and stripping, and the opinions of farmers as to the advisability of conducting all three operations for the safe and profitable removal of a wheat crop.

Table A.

Average time of starting operations.	T. Bragg, Mungeribar.	M. Brown, Terrabella.	C. Greene, Iandra.	C. Maslin, Grenfell.	J. Wren, Maryvale.	J. Young, Young.	H. Caughey, Mudgee.
Cutting for hay	Mid. of Oct.	Early Nov.	End Oct. and begin. Nov.	Nov.	End Oct.	1st week Nov.	1st week Nov.
Cutting with R. and B. for threshing.	After cutting for hay.	After hay cutting.	2nd week Dec.	Dec.	Mid. of Nov.	1st week Dec.	2nd week Dec.
Stripping	End of Nov.	Dec.	End Dec., begin. Jan.	Dec. and Jan.	End of Nov.	Middle Dec.	3rd week Dec.
Favourable to all three operations in removing a crop of wheat.	Yes.	Yes.	Yes.	Yes.	Yes.	Yes.	Not stripper.

As a rule, cutting for hay with reaper and binder starts, west of Wellington, early in October. In colder localities, as at Orange, the work is not undertaken until the latter part of November. Over the Western district, generally, haymaking is carried out, in one place or another, from October to December, the variation in rainfall and temperature of course affecting the maturity of the crop.

As will be seen from Table A, cutting for threshing for grain is generally one month later than for haymaking. Stripping operations commence a fortnight later than cutting for threshing, and are continued for varying periods up to six weeks. There is a period of eight to twelve weeks from the time of commencing cutting for hay to finishing stripping; the length of time occupied depending on the number of machines in use and men employed. A stripper or binder will cover 10 acres per day, and allowing five full days per week, each machine will do 50 acres. It is considered within the range of an energetic farmer to conduct all the operations of ploughing, seeding, and cultivating 200 acres for wheat, assistance only being required at harvest time.

It is not implied that all three operations in harvesting are the general practice with farmers. At Geurie, Parkes, Orange, Bathurst, Mudgee, and other places within reasonable distance of the metropolis, and with a rainfall generally sufficient to produce good straw growth, farmers within short distances of the rail cut a varying proportion of their crop for hay, the market price for chaff being the controlling factor.

In such places the reaper and binder is generally to be seen, whereas outside a radius of 16 miles from rail, as a rule, sufficient only of the crop is cut for hay for home consumption, generally a quantity equal to a twelve months' supply. In such places, and also in the country approaching the western boundary of the wheat-belt, the most favoured method of harvesting the grain is with the stripper harvester. There are not wanting instances where the reaper and binder and thresher find favour even in the drier portions of this district. Mr. P. O'Neill, of Narromine, an old Hawkesbury Agricultural College student, has adopted this method of harvesting his wheat crop, and for his straw stack of 50 tons last year was offered £4 per ton. Like instances could be quoted. This more satisfactory and sound method of removing the grain is gradually finding favour in the dry country. However, to the beginner with small capital, situated outside the range of profitable production of hay for market, the stripper harvester would be the best machine to commence with; but to the established farmer the pronounced opinions of the farmers given in Table A should influence him to include the binder in his harvesting machinery.

Before entering into a description of the relative merits of different harvesting methods, a few words on when to cut the wheat plant for hay will be in order.

When to cut for Hay.

Opinions vary little as to the time for cutting wheat for hay. The majority favour the period when the grain is just formed for their own use. Some like the grain well formed before cutting, especially for keeping for indefinite periods before chaffing. For marketing early, a fairly general practice is to cut while in flower. At Mungeribar the crop is at times cut earlier on account of the rapidity of maturing—that is, when a large quantity is to be conserved as hay. It is not advisable to store for any length of time hay that has been cut in the flowering stage, as it has a tendency to break up into dust when being chaffed.

In cutting oats for hay it is the rule to cut *when the grain is well-formed.* Some farmers cut when the oats are ready to thresh for seed, and the straw has lost all sign of green colour. If seed oats are selling at remunerative prices they thresh. Chaff from such matured plants is said to give great staying powers when fed to horses, and the straw is very sweet.

By making an early start in haymaking, a quantity, depending on the number of machines and men operating, may be cured and stacked before cutting for threshing, the time available being, as before stated, one month.

Portion to cut for Hay.

The portion of the wheat crop to cut for hay requires consideration. Table B refers to the experience of farmers on this subject, and the best time for cutting for hay, also methods of stooking.

Table B.

	T. Bragg, Mungeribar.	M. Brown, Terrabella.	C. Greene, Iandra.	C. Maslin, Grenfell.	J. Wren, Maryvale.	J. Young, Young.	H. Caughey, Mudgee.
What portion of crop to select for hay.	Heaviest, and if any with patches of oats.	The best ..	Heaviest growth and fire-breaks round crop.	Highest and best.	Cleanest and best for home feed.	Heaviest growth.	Heaviest.
Stage to cut for wheaten hay.	Flowering or earlier.	Grain fairly well formed	Just formed, flowering for market.	Just formed.	Flowering to well formed.	Just formed.	Well formed.
Methods of stooking ..	At first double row of 4 sheaves and 1 at each end, capped with 2 sheaves grain end uppermost; later, double quantity.	Large stooks	Long double rows, butts 2 ft. apart.	Round stooks.	20 sheaves in round stook, placed upright on ground.	Large stooks, sheaves upright.	Cut green, 4 sheaves in stook, tie on top; dry 8 or 10 in round stook.

From this it will be seen that the heaviest portion, that is the most prolific growth, is generally selected for haymaking. At Iandra the practice is to cut strips for fire-breaks around each paddock; this is also done in other places.

A number of farmers who seed wheat, such as Federation, for stripping, sow a hay wheat—generally one of the purple-straw variety—around the boundaries of the paddock and cut this for hay. The method is sound, if care is taken to free the grain from black oats and weed seeds prior to sowing, so as to have clean chaff for the farm horses, otherwise undesirable weeds and oats become spread by the droppings from the horses over the area reserved for grain. From observations of the wheat fields this season, the black oat trouble is increasing. To check the black oat, fallowing with proper cultivation is necessary, and clean seed and clean feed only should be used.

The wide-awake farmers select the cleanest portion to cut for hay for their horses, and cut the oaty portion for sale. If this latter is for the metropolitan market, or for cattle and sheep, there is little against such a method; but when distributed to other farming centres the practice is not to be recommended.

Should a crop be free from oats and somewhat of the same weight per acre, the portion to cut for hay would be that of uneven growth of a variety in which the grain is least valuable for milling purposes.

Cutting for Hay with Reaper and Binder.

In cutting a crop in the flowering stage it is well to set the binder to tie a small sheaf, the machine that ties tightly being preferred, for the shrinkage due to evaporation of water from the still green plants will soon loosen the bands, before any sign of discoloration from over-sweating occurs. After the first week, when the crop will, of course, have further ripened, a larger sheaf may be tied. It requires more power to tie a green than a dry sheaf.

Stooking.

After cutting, the sooner the sheaves are stooked the better so as to accelerate drying. Farmers differ somewhat in their methods of stooking. Any method of stooking must be that most suitable to prevailing climatic conditions. In a district like Orange, where a maximum time is required for drying, and where it is not unusual to have a wet harvest, the method somewhat generally adopted is to place two rows of six or eight sheaves, butts down, with a space of about 2 feet between the rows of sheaves on the ground, the sheaves leaning together at top. These are capped with other sheaves, with butt end up; the butt ends being drawn together and bound in various ways. In this way the stooks withstand heavy winds and are often left standing for weeks.

In the warmer and drier districts larger stooks, generally round, are the rule, and only ordinary precautions against damage by rain are deemed necessary. By placing the sheaves upright on the ground it is claimed that any rain will pass quickly through the sheaf to the ground and cause little or no damage. The general method is to make small stooks when the crop is cut on the green side, thereby exposing a greater surface to the atmosphere. The size of the stook is increased according to maturity. The notes on stooking apply also to a crop cut for threshing for grain.

Cut for hay the sheaves are safe to stack when the joints of the straw have shrunk somewhat and changed colour and almost free from sap. Should the cutting for hay be made in the flowering, or grain-just-formed stage, it is quite possible, with favourable conditions for drying, to have the whole of the hay crop stacked before it is necessary to start cutting for threshing.

Stacking.

Opinions differ somewhat as to the most suitable dimensions of a stack. The smaller farmer generally prefers a stack with a capacity of 30 tons. Some farmers in a big way prefer stacks of 120 tons capacity. Mr. Greene, of Iandra, and Mr. C. J. Maslin, Grenfell, like them as large as possible; shape immaterial; pitch of roof steep and convex; sides sloping well in from eaves. They make the same shape stack for grain and hay, whereas Mr. J. Young, of Young, prefers oblong stacks of 120 tons capacity for hay, and round stacks 25 feet in diameter for threshing. Mr. D. Ross and T. Bragg both favour round stacks for threshing, and place them sufficiently close that any two can be worked with the one setting of the machine. This method is worth farmers' attention. Mr. Wren, of Towri, favcurs large oblong stacks for hay when it is tc be kept indefinitely.

The practice in Mudgee is generally to build medium-size stacks. Mr. Caughey prefers a stack 5 yards by 10 yards for hay, and a little larger for threshing.

It may be said that the round shape, of a 30 to 50 tons capacity, is the favourite stack for all purposes. The size most common has a base 8 yards

in diameter. For hay stacking for home use it is well not to build large capacity stacks, for, as generally constructed, once they are opened up the sooner cut up the better. A stack on these lines should be built of a size depending on the storage capacity for chaff.

In building stacks in the open the locality selected should be one handy to the road and crop to be stacked. The stacks should be built where soakage is at a minimum.

In preparing the bed upon which the stack is built, prevention of absorption of water is generally obtained by making a bed of straw or timber.

In building an oblong stack the centre is not kept so high as with a round stack. The butts are placed outwards, and when the eaves are reached, generally about 11 feet from the ground, a practice somewhat common is to place a row of sheaves protruding a few inches beyond the

Chaff cutting.

lower ones. In a round stack the diameter at the eaves should be 3 feet more than at the base, and the square stack 3 feet wider at eaves. In topping the stack one method is to place a number of sheaves in the centre, the number depending on the pitch desired, each succeeding row of sheaves binding the one below. In finishing, each row of sheaves is gradually reduced in diameter, and overlapping the one below until the stack is finished. In a grain stack, by topping in this fashion, thatching is dispensed with in the drier portions of the West.

Thatching.

Thatching machines are not the fashion, and farmers who have them prefer hand-made thatch.

One method of thatching is to damp the straw, peg and tie it, the pegs sloping downward and covered by the next layer of thatch. For more permanent work, wire without pegs is used for holding thatch. At Iandra it is proposed to try galvanised iron for the roofing next season. When straw is not available many farmers use sheaves of hay, tied down and overlapping in a method somewhat as mentioned in topping a stack.

METHODS OF HARVESTING FOR GRAIN.

Table C.

	T. Bragg, Mungeribar.	**C. Greene,** Iandra.	**C. Maslin,** Grenfell.	**J. Young,** Young.	**H. Caughey,** Mudgee.
Working of a harvester in light and heavy crops.	When properly adjusted will take off a heavy crop cleanest.	Hardly as clean as a light crop.	Heavier crops are cleaner stripped.	Will strip a 20 bushel to acre cleanest, and a 40 bushel cleaner than an 8 or 10 bush.	Heavy crops, cleaner strip.
Cost of removing a 20 bushel per acre crop with harvester.	5s. to 6s., by contractor, little less by farm plant.	6s.	6s. to 7s.	4s.	7s.
Cost binding with R. and B., stooking, carting, and stacking.	....	£1 1s.	7s. to 8s.	11s. 9d.	s. d. Binding, 6 6 Stooking 1 0 Carting & stacking 3 0 10 6
Cost of threshing, per bushel, and stacking straw.	....	3d. to 6d.	6d.	Including stacking of straw, 4d. per bushel.	6d.
The loss of grain per acre with harvester.	About ½ bushel	1 bushel.	About ½ bushel, but a lot depends on man on machine.	In actual working of machine should not exceed more than ½ bushel; but loss from weather, through allowing crop to stand after ripe, may be anything, according to weather and time standing.	A low light crop, about ½ bushel.
The loss of grain after reaping, binding, and threshing.	....	Infinitesimal ..	Very little ..	Practically nothing ..	Very little, if wheat is not over ripe.
What is the relative value of the straw from thresher and after stripping?	Stripped straw worth about half threshed.	After threshing, £1; after stripping and cutting, 10s.	About £1 per ton after threshing.	Do not consider there is any comparison.	30s. after binding; 7s. after harvesting.

Mr. D. Ross, Comabella, considers that the loss of grain with stripper harvester would pay for threshing. Mr. J. Wren, Towri, Maryvale, prefers the stripper harvester on any crop yielding under 16 bushels to acre. He considers that a crop with such a yield would not pay to cut for threshing.

Table C shows clearly the method of harvesting that is the most profitable, viz., cutting with reaper and binder, stooking, stacking, threshing, and again stacking the straw, chaff, and cavings. This opinion is held by a number of experienced farmers, the drawback being the difficulty in getting labour to carry out the work.

The following is a further comparison of the harvester, reaper and binder, and stripper, as to the merits and drawbacks of each in harvesting.

Cutting with reaper and binder for threshing enables harvesting operations to be started at least a fortnight earlier than is possible in other methods. The grain harvested is generally heavier and of better colour. There is a smaller percentage loss of grain per acre. The straw is more valuable for stock, the value being variously estimated at 20s. to 30s. a ton.

In a dirty crop—that is, one where black oats occur—a considerable quantity of oats will be shed on the ground where the stooks were placed. The threshed grain will contain a greater percentage of oats than would

be the case with the harvester on a similar crop. A crop yielding under 10 bushels would be more profitably removed with the harvester.

Harvester.

By blowing over the chaff and cavings these are lost to the farmer, although, of course, a proportion is consumed later by stock. These cavings are useful for surrounding a stack of wheat in bags, and if a sufficient quantity is used mice are prevented from getting at the grain. They are also largely used for feeding stock in a time of scarcity. The advantage of the harvester is the rapidity of preparing the grain for market. There is a much greater percentage of cracked grain with the harvester than the thresher. While the output of wheat is only sufficient to supply the demand, millers are not particular about the presence of a few oats; but it costs 2d. per bushel to re-clean the wheat, and this may be passed on to the farmer in a time of plenty.

The cracked grain that would be removed by re-cleaning the wheat would increase the charge to the farmer to 4d. per bushel. The harvester does not remove all the oats. By blowing over oats and other light seeds it becomes almost a necessity, if a clean crop is the aim for the following season, to seed with wheat a fresh area each year, through this broadcasting of oats by the harvester.

Operations cannot be commenced with the harvester until the grain is fully ripe; a moist wind delays operations. Further, a loss variously estimated up to 1 bushel per acre occurs stripping with harvester.

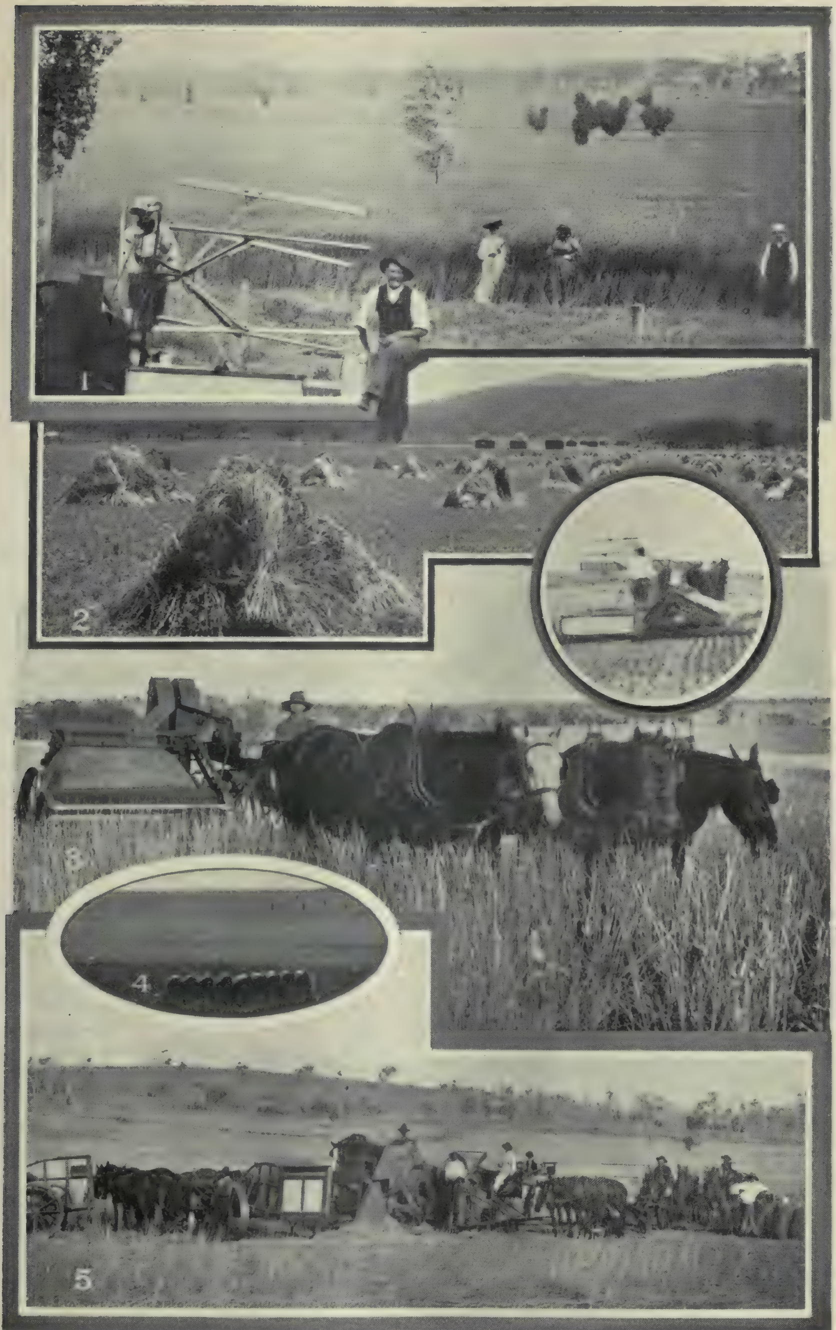
The stripper has been almost entirely superseded by the harvester, but away from rail it is still in use in places. The difficulty in procuring labour for cleaning the wheat had much to do with the stripper going out of general use. Its great advantage over the harvester is the expeditious manner in unloading, it being only necessary to tip the machine and empty the wheat and chaff on to a tarpaulin.

The straw, after threshing, is stacked, and, as a rule, held for dry times. It is also pressed into bundles and sold when a favourable market occurs.

After the stripper has passed over the field the straw of course is trampled, but this may be cut with the reaper and binder by working in the opposite direction to the stripper. Only a few instances of this being done have come under my notice, and then only on small areas.

Many farmers at present stripping favour cutting and threshing. They are not prepared to adopt the latter method of harvesting till assured of labour and contractors to carry out the work. One of the drawbacks with the harvester is the delay caused bagging the wheat. I made a suggestion to Mr. Wren to store in bulk a portion of the grain this coming season, and instead of sewing the bags, simply tie them at the mouth, cart into shed, and tip. At present is costs £1 per day for a man to sew and bag for two harvesters.

Mr. Wren will, this year, set aside a shed—mouse-proof—for bulk storage, and will run the grain from harvester into new chaff bags. In



Harvest Methods.

1—Ready for the machines. 2 and 6—The Reaper and Binder. 3 and 4—The Harvester.
5—Strippers and Winnower.

Allonby Farm—The advantages of the Sheaf-carrier.

Wagga Experiment Farm—Cutting and stooking.

Harvesting at Bathurst Experiment Farm.

THE REAPER AND BINDER AT WORK.

each bag about 2 bushels will be run, and a knot tied in the mouth of the bag. The bags will be carted in, emptied, and the grain stored in bulk in the shed. The leading millers have taken a step in the right direction by erecting grain silos.

A few words in reference to the "Push" harvester. This harvesting machine has not so far been extensively used here. There are a few, however, in use, one being at Narromine. It takes eight horses to work it. The opinion is held by some farmers that two harvesters on the draught principle, each with four horses, will cover more ground per day than the "Push" harvester. This matter, however, requires further investigation.

There is a need for a combined threshing and bagging machine that will carry the straw, chaff, and cavings away with a blast attachment. The machine at present used takes generally eight men to work it.

The "header," a machine that cuts off some 8 inches of the head and threshes it while in motion, will be introduced this season to farmers' notice by a Sydney firm; but, without practical knowledge of its capabilities, I can express no opinion concerning it.

Selection of Seed.

The selection of grain for the following year's seeding has not, as a rule, the attention given to it that one would expect. The most careful farmers select the cleanest portion of the crop for stripping or threshing for seed, and re-clean before sowing. A few have grading and cleaning machines. The value of grading and cleaning machines is recognised, and an increase in the number in use may shortly be noted. A method whereby a farmer would ensure getting plump and clean grain for his next year's seeding would be somewhat as follows:—Having first decided on the area he purposes to sow the following season, he selects, in the cleanest portion of his farm, an area that will with an average crop yield sufficient grain for his requirements. The position selected should be the most favoured as to protection from the worst drying winds, and where the soil has a high moisture-retaining capacity. Take an instance of a farmer who purposes sowing 400 acres with wheat, at the rate of ¾ of a bushel per acre, he would require 20 acres on the plan proposed, presuming that the yield from this portion of the land would be 15 bushels per acre. The 20 acres should receive extra cultivation and care in seeding. Adjoining it an additional 20 acres would be fallowed and thoroughly cultivated and kept free from weeds, ready for the following year's seeding. By some such method clean, plump seed would be obtained, even in a year when, due to unfavourable climatic conditions, the bulk of the grain from the rest of the farm may be pinched and low grade. By grading his selected grain a greater uniformity will be obtained in his subsequent crop, and this selection will show an improvement in each succeeding crop if conditions are favourable; but he will, by keeping up the standard of his seed, guard against deterioration, which at the present time is lamented by farmers.

HARVEST IN THE RIVERINA.

G. M. McKEOWN, Manager, Wagga Experiment Farm.

WHEAT.

As soon as possible after the completion of each harvest, all machinery should be carefully examined and cleaned. All parts which are sufficiently worn to make their use unsafe should be replaced, and duplicates of those which are partially worn, but which may still have a fair amount of working power left, should be purchased and kept ready for emergencies.

As the machinery parts of which duplicates are obtainable are castings, they cannot readily be repaired when worn or broken, therefore it is necessary to procure new ones to replace them.

In all cereal-growing districts, periodical visits are made by machinery experts, who overhaul and refit all classes of harvest machines, therefore all farmers who do not possess the necessary mechanical knowledge and skill to enable them to repair their own machines may obtain skilled assistance at any time, so that the risk of loss of valuable time during harvest may be reduced to a minimum when such assistance is availed of early.

The use of the reaper and binder is recommended, for the following reasons, viz.:—

1. It is possible to place in a position of security a crop, or a considerable portion of it, while it is in a condition in which it is far less liable to damage than when it is left to ripen sufficiently to render possible other methods of harvesting.
2. A crop is in a condition for cutting at least a fortnight earlier than is possible for stripping, and the work of cutting may proceed under weather and other conditions unfavourable for the latter work, thereby admitting of much time being gained.
3. When a crop is allowed to ripen to a degree necessary to admit of stripping, one day's hot wind may cause the loss of the entire standing crop, while such conditions would be harmless to stacks, and comparatively so to wheat in stooks.
4. Much less grain is shed during the cutting of a crop which is seasonably dealt with than is the case when the stripper is used under its most favourable conditions, and the binder removes and includes in the sheaves the whole of the ears, while in an irregular crop many low heads are left untouched by the stripper or harvester.
5. The weight and colour of the grain which has been cut and stacked are superior to that harvested by other means, as in the latter case bleaching and loss of weight are to a greater or less extent inevitable.
6. Seed-grain which has been so harvested will prove much less liable to have its germinable power affected under treatment with smut preventives than grain which has been harvested by other methods.

7. Land upon which crops have been cut will always be found freer from wild oats and weeds, as such plants are to a great extent removed in the sheaves and dealt with in threshing and cleaning.
8. The value of the straw is always worthy of consideration, as, no matter how long it may be kept, our experience has shown that periods will occur when its value will be considerable.
9. When used for harvesting barley, there is less risk of injury to the grain, therefore it will be valued more highly by maltsters.

The value of the straw is, practically, admitted by many wheat-growers who at present use the harvester or stripper for their grain, as they afterwards cut the straw with the reaper and binder. Many, however, destroy the whole of the straw by fire, thus depriving the soil of even the benefit of ploughing-in the stubble, such as is left by the reaper and binder. After the stripper or harvester much of the straw cannot be harvested, owing to it having been knocked down by the first teams and machines, while the value of the rest will have been greatly depreciated by bleaching. In the long run, it will be found that the extra cost of cutting, stacking, and threshing is far more than compensated for by the advantages gained.

A difficulty exists in many districts owing to the lack of contractors for threshing, but the demand would induce a supply. The economy of cutting and threshing even a portion of the crop is strongly urged. In districts where the practice has been tested, there is no desire to depart from it. In our district, since the drought of 1902, I know that there has been a demand for threshing of grain, at double the rates prevailing in districts where threshing is the rule, and where, in consequence, more contractors' plants have been available.

Time to cut.

Wheat-cutting should be commenced when the crop presents an even condition of ripeness, which will be evident in the rapid drying of the straw from the lower joints upwards, and in the condition of the grain, which should be well set and quite firm.

Barley should be in the stage at which the ears are drooping, and the greater part of the crop presenting the most even condition of ripeness possible. Sometimes patches may be backward, but it is better that these should ripen in the stack rather than that cutting should be delayed, as the risk of damage by high winds at the former stage is considerable.

OATS.

When ready for harvesting, a crop of oats should present an even, white appearance, the grain being firm and of even colour, but cutting should be carried on before the chaff opens sufficiently to admit of the grain shedding during cutting and binding.

For stripping, the crop may be in a more advanced condition, so that the grain may more easily separate from the chaff.

Stooking.

This work should be carried out with the greatest promptness, a sufficient gang of stookers being engaged to keep pace with each machine, so that at the close of the day's work no sheaves shall be left lying on the ground, where they will be subject to injury by drawing moisture from the soil. Even should the soil be dry, delay in stooking may cause loss of grain, especially when the straw dries rapidly, through the great heat which at times prevails.

Stacking.

Carting to the stacks should be placed in hand as soon as the sheaves are sufficiently dry to avoid risk of sweating, the bottoms of all vehicles being covered with large cloths to prevent the loss of any grain which may be shed in the handling. All stacks should have their bases secured against risk of moisture rising from the soil, by a good layer of straw or timber, and drainage should be provided to protect them from damage by surface-water. The best size for stacks is about 27 feet by 15 feet, to contain about 50 tons. This size is the most economical of labour in construction, as well as in demolition for the purpose of threshing or chaff-cutting. The width should be gradually increased to 18 feet at the eaves, thus ensuring proper drainage from the roof, as the water should fall clear of the sides of the stack. The sheaves should be carefully placed in position, butts outwards, with a slight downward slope outwards, which is obtained by keeping the middle of the stack well filled and slightly raised, care being taken that all sheaves are bound in position by others. A skilful builder will accomplish the work with a fork, without the necessity of kneeling to put the sheaves in position, the former method being more expeditious. The access of rain should be prevented during the process of erection. The eaves should be about 12 feet from the ground, and to form them the last row of sheaves should project about 6 inches. To gain the necessary pitch to the roof, three double rows of sheaves should be placed in the middle of the stack, lengthwise; but if the sheaves are not bulky more may be required The necessary pitch may be maintained by placing each layer of sheaves (still butts outwards) further back than the next underlying it, so as to obtain a continuous slope to the ridge, the relative position of the middle being carefully continued and the outer sheaves bound by the inner rows.

In the Wagga district, where the rainfall is not heavy, we are able by this method of building and topping stacks to dispense with the expense of thatching, as only the butts of the outer sheaves become damaged. These are cut off, and the upper portions of the sheaves are used as stock-food when the material stacked is hay.

HAYMAKING.

Wheat.

Cutting of the crop should be commenced when the earliest of the flowers are appearing, as it is desirable that it should be cut before the grain forms in the straw.

Wagga Experiment Farm—Carting to Stack.

Stacking at Allonby, Wagga.

Effect of a gale of wind on bad stacking—note hay sheaves blown against fence.

A favourite form of stack.

Stacks placed for economic working.

Rectangular Stacks.

TYPES OF STACKS.

Wheat is an indigestible grain, with which it is easy to overfeed horses and cattle, therefore, if it is desired to use it, it is better to add it to chaff, and to crush or boil it before doing so.

The hay, also, when saved at that stage of its growth, is far more digestible than is the case when grain has been allowed to ripen in the straw, and a heavier crop may be harvested. If properly saved, its feeding-value is better, and it is much more palatable to stock.

In the city markets, chaff of bright green colour, cut from half an inch to five-eighths of an inch in length, will always command top prices.

Each reaper and binder should be followed by a sufficient staff of stookers to ensure prompt stooking of the sheaves, in order to prevent discoloration by moisture from the soil, and to bring them into the best position to receive the full effects of sun and air.

Not more than seventeen good-sized sheaves should be placed in each stook, so that sun and air may have free access right through them. When of moderate size, the stooks dry-out more rapidly after rain, without the necessity of turning the sheaves.

The time necessary for curing will, of course, vary with the crop and the state of the weather, from eight days upwards usually being required.

Before carting to the stacks, its condition may be tested by taking some of the hay from the middle of the stook and breaking and rubbing it in the hands to ascertain its moisture contents. It is desirable that, as far as possible, bleaching shall be prevented by stacking promptly.

Oats.

As it is necessary that oaten hay should contain a full supply of grain, the crop should be allowed to attain a much more mature condition than is necessary with wheat. The best indication of a fit condition is when the upper tips of the heads turn white, the grain in the lower portion being then in the dough stage.

Algerian oats may be allowed to advance somewhat beyond that stage, as it has a tendency to make bitter hay if cut on the green side. It will, however, be found one of the most reliable varieties, as it thrives under dry conditions, and under most circumstances it will be found rust-resistant.

Good white varieties will be found in Newmarket, Colossal, Abundance, Tartarian, White Ligomo, and Great Northern.

For ensilage or feeding-off these varieties will always be found successful and satisfactory, as their upward growth is more rapid, and they are sweeter in their earlier stages of growth than the Algerian.

Stooking may be carried out as advised in the paragraph on "Wheat," and every care should be taken that the carting and stacking are promptly carried out, so as to preserve the colour and the best feeding qualities of the hay, and to prevent loss of grain by shedding during handling.

Natural Grasses.

In seasons of plenty, a stock of excellent hay may be obtained by conserving the natural grasses and pasture plants. In some localities, where many varieties of grasses are to be found in conjunction with a good proportion of trefoils, its feeding-value will be found satisfactory if properly prepared.

The locality on which it is intended to cut the natural herbage for hay or silage should be selected as early as possible while the growth is still short, so that all stones or pieces of wood likely to injure mowing machines may be removed before commencing operations.

The best period of growth at which to cut is at the flowering stage, so as to secure fodder of the most nutritious quality, as well as to avoid the ripening of seeds, which may prove troublesome to stock when feeding.

As in the case of lucerne, prompt handling of the crop is necessary, as long exposure causes the hay to deteriorate.

Many of the grasses dry more rapidly than lucerne, therefore in hot weather it should be, as soon as possible after the mowing machines have passed, raked into cocks to prevent too rapid drying.

The material should be well trodden in course of stacking, so as to secure compact structures.

A dual purpose is gained by thus conserving natural herbage, as the mown areas serve well to check the progress of bush-fires.

Harvest in the South-Western District.

H. ROSS, Inspector of Agriculture.

Various opinions exist among wheat-growers as to how a crop should be harvested to the best advantage. While some farmers say the proper method is to cut with reaper and binder, and subsequently thresh, others again maintain that harvesting with a stripper or combined harvester is the best means to be employed. In considering the different merits each of these systems of harvesting is entitled to, we must not lose sight of the fact that the most economic and expeditious method for his conditions is the one which is sure to appeal to the practical farmer.

The system of reaping and binding the crop has much to commend it. The crop can be harvested much earlier than it could be taken off by stripper, thus avoiding risk of hot winds and fire. The straw is of better colour, and its value slightly higher than straw from wheat that has been stripped, and a larger quantity of straw can be gathered in this way than by using a harvester, followed by a binder. Theoretically, this method of harvesting would appear to have every advantage: not only is every blade of straw saved for future use, in case of drought, but the straw itself is of fair quality.

There is, however, one great disadvantage connected with this method, and that is its costliness. The sheaves, after having been cut, require to be stooked, carted, and stacked; binder twine is a considerable item, 2s. 9d.

to 3s. per acre in a fair crop; and threshing cannot be carried out for less than 3d. per bushel.

The extra cost of binding and threshing as compared with harvesting with stripper harvester is fully 12s. more per acre, and it is very questionable whether the little extra straw gained or the better quality of this straw will compensate the farmer for this additional outlay; unless a dry season sets in, and so improves the market value of straw, it is so much capital locked up, without bearing interest.

Some of the latest make of harvesters have attached to them a chaff-carrier to save the "beeswing," or, as it is often termed, "cocky chaff." It is a box attached to the back of the harvester, and can be procured for about £3 10s. to £4. No time need be lost emptying it, and as its employment involves no extra labour, farmers will do well to consider the advisability of employing this means of saving, and making use of a material which otherwise would go to waste. As regards the straw, I consider it bad policy to burn it. A binder run over the paddock in the opposite direction to the harvester will ensure a farmer gathering 75 per cent. of all the straw that is there.

The little potash gained from burning off is not worth considering; the only point that may possibly count in its favour is that the fire destroys the eggs and larvae of insects. An advantage which stripping has always over binding and threshing is that the owner is in a position to sell his wheat immediately after harvest should there be a rise in the market; whereas if he has to wait until the threshing machine comes along, he may have to sell his crop on a falling market.

Comparing the two methods of harvesting, the consensus of opinion among wheat-growers in the South-west points strongly in favour of the combined harvester, with binder following in opposite direction, if the straw is required.

A few hints.

A certain amount of grain is always shed before the comb of the stripper touches the heads, and a little is often lost through the driver having too much blast on. The farmer, however, need not regard this as a total loss, for if the stubble be lightly scarified immediately after harvest, the early autumn rains will readily germinate the wheat, and a fair amount of good feed may in this way be obtained at a time when the natural pastures are mostly bare.

Harvesting Bunty Crops.

In harvesting a wheat crop, it is advisable to leave the bunt-affected paddocks, if there are any, to the very last; the drier the bunt the more easily will it be blown out of the grain by the fans of the harvester.

The problem of Uneven Growth.

In a standing crop of wheat it will be frequently noticed that a fair percentage of plants are considerably shorter than the rest, consequently the comb of the machine, which is set to a certain height, misses these stalks; the loss in this direction is sometimes considerable, and no device has been

invented yet to overcome this difficulty. What is the cause now that between plants of the same variety of wheat, standing side by side, a difference in height of 6 inches or more should exist?

The fault can generally be traced to non-uniformity of the seed sown; different grades of wheat are contained in one bag, and if sown without having been graded, different heights will be attained by the respective plants. While we have no attachment on the harvester to take in the comb these short stalks, we have the remedy at hand to, at any rate, minimise their occurrence by thoroughly grading our seed wheat. The necessity for grading so as to have a uniform sample cannot be too strongly impressed; a crop grown from graded seed will invariably prove to be of more uniform height than one grown from non-graded wheat.

Stacking Bags in Paddock v. Shed.

The question is often being debated whether bags of wheat should be stacked in the paddock or carted in to the shed. My advice is to cart in immediately. Having carried out experiments for a number of years, I have found that wheat stacked in the paddocks loses on an average 7 lb. per bag in weight. This means, in a 20-bushel crop, and wheat at 4s. per bushel, 2s. 4d. per acre, an amount sufficient to cover expenses of binder twine to bind one acre of straw. Bags of wheat carted in and stacked in shed not only were found not to have lost in weight, but in some cases were actually proved to have gained. An easy way to cart wheat from the field is on a low trolly, 18 inches high, drawn by a single horse.

Cutting Wheat for Hay.

The proper time to cut wheat for hay is when, as it is generally termed, it comes into flower; it is better, however, to err a little on the green side, than allow it to become too ripe.

Little need be said in regard to stooking, excepting that it will always pay to make the stooks compact, thatching each stook with some of the sheaves; the more pointed the stooks are the less danger there is of getting spoiled by rain storms.

Cutting Oats for Hay.

Oat crops (Algerian) cannot be cut for hay on the green side because, unless allowed to come to a certain stage of maturity, the hay will have a decidedly bitter taste, and horses will refuse to eat it.*

Stack Building.

In building hay stacks, I am of opinion that it is more profitable and easier to build one large stack than two or three smaller ones.

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* In view of the general impression that oats cut earlier than almost mature produce unpalatable and bitter hay, the practice followed at the Cowra Experiment Farm is interesting.

It being necessary in connection with wheat experiment work at Cowra to feed oaten hay exclusively to the farm horses, Mr. Sutton has cut regularly for the past five years his Algerian oat crops when in flower. The chaff has always been readily eaten by the Cowra Farm horses and by the horses of visitors. Indeed, many farmers visiting the Farm have remarked on the excellence of this chaff.—Ed.

The oblong shape, I think, is preferable to any other, and to build the stack long and rather narrow will be found more economical than to build it too wide; a wide-built stack, when being opened, exposes too large a surface to the weather.

18 feet x 60 feet will be found suitable dimensions. Choose a slightly-elevated site, level the surface of the ground, and mark out the above dimensions by drawing a line along the ground, erect a pole 18 feet high on each corner; the poles will act as a guide to the stacker how far to come out with the sheaves. A thick layer of straw to build the stack upon will be found useful, as it prevents the bottom sheaves from coming into contact with any moisture that may be contained in the ground. Start building the stack from the outside edge, laying one layer of sheaves butt outwards at right angles to the stack; when approaching the corners slightly slant sheaves until the corner is reached, and right at the corner lay one sheaf diagonally across the stack, that is to say, the centre of the butt of the sheaves facing the pole at the corner; the inside sheaves of the stack should be laid alternately, one row butt outwards, the other row butt inwards.

While building, care should be taken to always keep the centre of the stack a little higher than the edges; doing this will ensure the centre being packed tight, and will prevent sinking and water from lodging in the stack. Should water enter the stack, and the centre is tightly packed, it will always run out. Push eaves sheaves 4 to 5 inches out all round, and finish with single sheaf; remove corner poles when finished, and plough 9 feet all round the stack to guard against fire.

Never thatch with straw which has been threshed. Threshed straw is bruised, and not water-tight. Rye straw, on account of its length and close texture, makes the best thatch.

Precautions against Mice.

Many devices have come under my notice from time to time to cope with the mice pest. Building the stack upon a raised platform does not answer the purpose; the mice will climb up the blocks upon which the platform is built, run along underneath the platform-boards, and so enter the stack.

Enclosing the stack, as some farmers do, with fine wire-netting, will also be found to be unsuitable, as the pest will climb up the wire-netting.

The only successful method I have seen to keep them out, is to enclose the stack with a fence of galvanised iron, either plain or corrugated, about 2 feet high.

Let the iron into the ground to a depth of 4 inches, and place it into a slanting postion, pointing outwards from the stack, all round it, taking care to leave no open space at the corners; it will be found impossible for mice to enter a stack thus protected.

If it should be found that mice are troublesome in the stack, poison with arsenic dissolved in water. Place dishes of the solution all round the stack; if it will not entirely eradicate the pest, it will, at any rate, help to keep it in check.

Harvest on the Northern Tableland.

R. H. GENNYS, Manager, Glen Innes Experiment Farm.

THE period at which any crop is harvested is of very great importance, for it affects the quality and often the quantity of the crop produced.

It is well not to sow too much at about the same time, unless they be an early and a late variety, so that all will not ripen together, and give all a chance of being harvested when fit.

Harvesting for Grain.

The reaper and binder is generally preferred, as the straw is very valuable, both as rough fodder and bedding; and, moreover, sometimes the crops here are uneven in maturing; the reaper and binder, too, leaves less seed-heads of weeds behind it.

Experiments have been tried here in harvesting for grain at different stages, viz., in milk, in dough, ripe, and dead-ripe. It has been shown for certain that the milk stage—that is, when moisture can still be squeezed out with the thumb and finger—is too soon, for the grain will shrivel up, and there is also a great loss in weight.

The dough stage—that is, when the grain is still somewhat swollen and is yielding when pressed hard with thumb and forefinger—gives grain of a very attractive, translucent appearance for marketing; and the yield so far, in two cases out of three, has been larger than in the ripe stage, as in some wheats much is lost through shelling in the field; the straw, too, is of very much better colour, and more nutritious for fodder.

The ordinary, or ripe stage, gives a grain of good appearance, but scarcely as attractive as the dough stage; if a stripper be used, this is the proper stage.

The dead-ripe, really the over-ripe, and when much grain, in some varieties, shells badly, is manifestly not right, and on exposure may bleach badly. At this stage straw will be dry, brittle, and very innutritious.

Stook wheat sheaves, that air may pass through capping, with sheaves to throw off rain. In the dough stage, a little more time in field must be given.

Harvesting for Hay.

Wheat harvested for hay or chaff should be cut at the flowering stage, and should not be allowed to form grain, for untreated wheat grain is an indigestible form of presenting the nutrient matter of the wheat plant for the use of stock, either in hay, chaff, or grain. Cutting at the flowering period also gives colour and sweet odour, so dearly prized by stockowners.

Oats.

In harvesting oats for grain, the heads should be well whitened before cutting.

For oaten hay, cut when the tips are just beginning to turn white, and at a later stage than for wheaten hay, as the oat grain, unlike wheat, is very

nutritious and digestible for stock; but the colour of the straw must not be lost sight of. Varieties that ripen first from the top should be chosen for hay oats.

Oaten and wheaten hay now cut with reaper and binder, in small sheaves. A substitute is the mower, or even the scythe, leaving crop on the ground in windrows, to be afterwards turned over and put into cocks till ready to stack.

Grasses for Seed and Hay.

Grasses generally should not be cut for seed till after the third year, as the perennial nature is more likely to be transmitted.

Cut grasses close to ground for short, nutritious portions.

Cocksfoot may be cut for hay, but not till the second year. In the spring crop, which is more nutritious than later growths, feed down fairly close and not cut first year, except to strengthen the plant in an early stage. Cut when heads first begin to form, for hay.

Perennial Rye for seed.—Cut after the third year for best seed; for hay, after the first year, in the flowering stage or just after. In no case cut perennial rye during first year, or the pasture may be weakened beyond recovery.

Timothy.—Cut for seed when thoroughly established, and for hay at flowering stage.

Phalaris.—Cut as soon as it comes into head, before getting coarse and woody, for hay; for seed, when heads are well ripe and seed full and bright.

Clovers.—Treat much the same as lucerne in harvesting; take care of the leaves.

Harvest in the North-Western District.

W. R. FRY, Inspector of Agriculture.

The following suggestions are intended more especially for persons possessing only a limited amount of experience in harvesting operations, but, at the same time, wheat-growers who know all about the game may, perhaps, note some seasonable reminders.

Preparations for Harvest.

One of the first things for the grower to consider is, whether he will allow the crop to mature grain or cut for hay. Owing to the exceptional rainfall in most districts, feed is plentiful, therefore hay and chaff is not likely to bring exorbitant prices in the spring; and with new wheat already quoted at a comparatively high rate, many growers will prefer to let their crops ripen. If, however, the drooping season continues, there will be considerable risk of

rust, especially in the purple straw varieties in strong soils, and these should be cut for hay. Again, in long-cultivated paddocks the black oat pest should be considered. Cutting for hay is preferable to stripping, but it does not entirely remedy the evil, for many of the oats shed-out while in the stooks. The best plan with very dirty paddocks is to cut the crop very green, and cart direct for stack ensilage. Where thistles are plentiful, they should also be cut, before the lower leaves turn yellow, and mixed with rank wheat or oats for silage. In the event of a dry time this ensilage stack may prove the salvation of the ewes at lambing season. The two-horse mowing machine could now be profitably used on many farms for cutting weedy headlands, firebreaks, roadways, and rank and lain patches. The greenstuff, if insufficient for ensilage, should be raked together and made into long hay for rough farm feed.

Regarding clean paddocks, will it be possible with one or two harvesters to collect the grain sufficiently early to escape risk of storms and bleaching? Wheat like Steinwedel may shell-out half its grain before the machines can get through. Wheat like Federation will stand plenty of storms, but it may bleach badly, even without much rain, and the millers will offer a lower price for it then. Again, in rich, strong soils a crop may ripen unevenly. Even where sheep have been put on the crop they will have left many rank patches, which will have since gone down, and this tangled stuff is bound to cause trouble with the harvester later. Even with the false combs, much grain will be lost. Taking these facts into consideration, it will probably pay to cut a fair area with the reaper and binder. The binder can start work at least a fortnight earlier than the harvester, but, of course, the grain will not be on the market any earlier, for it has to be threshed. Still, that can be done after the rush is over, and when assistance can be more easily obtained. Millers promise 1d. per bushel more for threshed wheat; the grain weighs better and the straw has a much greater feeding-value. Remember the binder can work in weather unfavourable for stripping, will cut and collect short and long heads, whilst some of the black oats and other weed-seeds will be cut before maturity, and removed with the sheaves. With the harvester, on the other hand, weeds are generally distributed, unless a chaff carrier is used, but this is not much favoured by many farmers.

In districts where there are no travelling steam-threshing machines, it would be advisable for a number of adjoining farmers to agree to each cut a certain proportion of their crop with the binder and co-operate in an endeavour to persuade a travelling thresher to visit the locality. If a number of farmers offer sufficient inducement, the demand will create the supply. Where there is no possibility of obtaining the services of a threshing machine, it may be advisable to cut a fair proportion of the crop for hay, especially if near a railway siding.

At any rate, get the binder ready. Tighten-up bolts; see that the canvas works well and free, also that any roads, bridges, or gateways into any new cultivation paddocks are wide enough for binder and team to pass, without having to waste time altering on to transport wheels.

Harvesting for Hay.

Do not be too long thinking about cutting the hay, or the crop will be too ripe. To produce prime hay the wheat should be cut when the earliest flowers appear and before the flag becomes too dry. Although many farmers still have a prejudice in favour of grain in the chaff, it is not desirable. Wheat is an indigestible grain for horses, unless boiled. Many show judges now disqualify wheaten chaff containing plump grain. For the Sydney market, good bright-coloured chaff, about ½ inch to ⅝ inch in length, without grain, brings top price.

By the time the harvest commences, see that the horses are in good condition and fit to be pushed to cover 12 to 14 acres a day. The hay should be stooked as soon as possible, and no sheaves left lying on the ground overnight.

In a light crop, one man may manage to keep up with the stooking, but if over 2 tons per acre is being cut it will take two men all their time. By proper use of the sheaf-carrier stooking may be made easier.

In warm districts, stooks of 15 to 17 sheaves are ample, and the hay may be fit to cart in after seven days. Test if fit by breaking a straw from middle of sheaf; if sappy, leave a while, but if brittle make every effort to get it into the stack as soon as possible. The chaff will weigh heavier if carted and cut direct from the stooks, but there is a risk of it becoming musty when this practice is followed.

In the New England district many farmers prefer to place only 4 sheaves in each stook, and tie the tops together. Small stooks like these dry more readily, owing to free passage of air, and if blown over are easy to re-erect.

When carting sheaves to stack, do not forget to put sheets on the bottom of the dray, to collect any shed grain. Perhaps only half a bushel will be saved in this way each load, but that is worth the small trouble involved, and the same sheets will prove handy if rain comes on when building the stack.

Now, about the stack. Presumably, it is to be built on high land, as safe as possible from fire, flood, or stock. It is well to plough a drain around the site, and scoop the soil up to raise the centre of the stack-bed. Soil is better than slabs of timber, as there is less risk of mice. A load of dry straw at bottom is advisable. If the paddock will yield 50 tons, a nice, handy size for a stack is 30 feet long by 15 feet wide at bottom and 17 feet at top, so that sides project a foot each side beyond the base. If likely to be 100 tons or over, make two or more stacks. With a number of stacks there is less risk of fire, besides being more convenient for working.

Experienced men prefer circular stacks, but for the beginner the oblong shape is best. Commence laying sheaves carefully in rows, with butts outwards. At first it may be found necessary to kneel on the sheaves, but with additional loads and confidence they may be placed in correct position with the fork. Beware of building up a wall around the sides with a hollow in the centre, but keep middle well filled. Endeavour to keep the surface face

flat, or with a slight slope outwards. Make a beater by bolting a piece of slab, about 10 in. by 10 in. by 2 in., on to a pole, and with it belt the ends of the butts at sides well in, especially when any bulges begin to show. After getting sides of stacks secured up well to about 12 feet high, commence to make eaves, by allowing the top line of sheaves to project about 6 inches; then start to ridge up. Keep middle full; place three double rows of sheaves longways in centre. Continue crossing the sheaves, keeping each side of the layer further back than preceding layer, to make a regular overlapping fall from the butts outwards all the time. By this method thatching will be unnecessary in the warm, dry districts, as rain can only damage the butts of outside sheaves.

Most of the farmers in the moist New England districts possess fair-sized hay-sheds, but when sufficient shed-room is not available it is advisable to make an attempt by thatching. After building stack, with a good pitch, in layers as described, cover the two sides with another row of long sheaves, commencing at the bottom and overlapping each layer. Then cover with more long rye-straw, or rushes if easily available, or cut bands of sheaves and peg them on. If very dry and brittle, moisten the straw by soaking in a trough of water. Always work from the eaves upwards. Peg and fasten securely, or tie twine over each bundle, and finish with a good ridge-cap over each side. When haymaking in wet districts, if much rain falls on stooks they should always be opened out when the ground is dry enough before carting in.

Farmers should try protecting some of the wheat sheaves, say, half the paddock, by covering the stooks with caps made with rye-straw, tied together at the head and spread over. These would prevent much bleaching and deterioration of grain by rain, and as the tablelands will produce excellent grain of the Fife and Manitoba varieties, the additional price will probably pay for the slight extra labour.

Harvesting for Grain.

In the chief wheat-growing districts, most of the growers, on account of cheapness, and difficulty of obtaining and retaining reliable assistance, prefer to use the complete harvester, although by so doing they frequently risk the grain, and generally sacrifice the straw.

Many farmers effect temporary repairs with the inevitable piece of fencing-wire. These makeshifts should now be replaced by proper bolts or clamps, as required. Oil-up all parts requiring lubricating with mineral oils, but use neatsfoot oil for leather belts, and give the machine a run round before putting into crop. Order early any duplicate parts that may be required. Do not wait until crop is ripe. It is generally advisable to have an extra pinion-wheel on hand. Many farmers complain that the spreader-bar, where the shaker works, frequently breaks. Most of the newer machines have been improved by a ball-eccentric shaker; but if trouble occurs there it may be remedied by attaching the shaker by two small bolts, about 1½ inch long, with a nut and washer inside. Two fresh holes must then be drilled

an inch or so higher, near the spreader-bar. Any ordinary piece of ½-inch iron will do for this, and a piece of threaded bolt can be welded on end, if stocks and dies are not available. Adjust the beaters in front of the drum by means of the set screws, so that they will just knock off a full-sized grain from the diamonds of the concave. For an ordinary crop, the beaters should revolve about one-eighth of an inch from the comb; in a tough crop, a little further forward; but if very dry and loose, it should be set further back.

In patchy crops where the soil is loose and the comb inclined to choke by straw pulling-out by the roots, attach a roller. This can be made of any rough, unbarked sapling, about 4 inches in diameter, sawn off to the length of the comb, and attached by a chain at each end. This will be found a very cheap and useful addition for harvesting a crop with rotten straw.

Tighten bolts on elevator before starting, and again after a few rounds of the paddock. See that spikes on peg-drum thresher pass in the centre of space between plates. If all are too much to one side, the spindle can be altered by the two collars on each side. Any individual spike that may have been bent should be straightened with a hammer and chisel. In regard to the false combs, those made by the local blacksmith out of steel fingers and a piece of piping are generally superior to the false fingers provided by the implement-makers. The "Push" harvesters take a wider strip, with the same horse-power, as they do away with the side draft. Most of the latest harvesters are splendid machines, and with careful handling will harvest not only wheat, but oats, barley, rye, and even lucerne seed. In deciding upon a machine, farmers should be guided by the experience of their neighbours, also their convenience to a local agency for duplicates, &c. Any machines can be obtained for a nominal deposit, and liberal terms extending over three or four years, if required. When the machine arrives, and the starting certificate is signed, the agent's responsibility ceases. Therefore it is advisable to get all possible information from the expert while he is in the field. Get him to prove the machine on high, low, and tangled patches. Also take special care of the little book of directions. Some particular information may not be required now; but, perhaps, next season the crop may be short, tough, or rotten, or a patch of barley or oats may be grown, and the book of directions will be necessary for special adjustment. With any harvester that has a back blast, a chaff-carrier should be fixed. This will collect much black oats and weed-seeds, and save their broadcast distribution in the paddock. The cocky chaff or oats collected in the carrier should be fed to cows, and not to the working horses, unless the oats are crushed.

Keep close watch on the riddles, which should be working level, except when going up hill. When thistles are troublesome, give the riddles a slight tilt forward, to reduce the blast.

The actual details of the harvesting depend on the particular kind of machine, therefore only general suggestions can be given. Each driver should study his machine according to makers' directions. In many paddocks much grain is lost by a neglect of instructions and general carelessness. Some drivers,

when the machine becomes choked, actually throw the accumulated grain from the combs or beater on to the ground. Stubble-fields are sometimes to be seen covered with grain. Certainly sheep may pick up much of it, or get a green bite from the self-sown crop afterwards, but generally sparrows or other birds get the best share. Every effort should be made to prevent any of these leakages. Even the loss of only 1 bushel per acre may mean as much as £20 on every 100 acres of crop.

An effort should also be made to save as much of the straw as possible. Where practicable, the binder should be put into the best standing patches of Steinwedel, Bobs, Comeback, or similar varieties which have sweet straw, and cut before it becomes bleached. If a team and binder cannot be spared, a lot of straw can be collected with a one-horse hay-rake. This rough straw will be found very useful for several purposes on the farm. It can be used for thatching shelter-sheds, filling-up gullies or wash-outs on steep hillsides, or mulching fruit-trees or potatoes. Potatoes can be grown in very hot districts if well covered with straw.

If any portion of the crop is noticed to be particularly affected with bunt or smut, it should be harvested and bagged separately.

When stacking the grain after harvesting, the bags in the paddock should not be stacked on their sides, but stood on end and not touching, if possible, to protect from mice. If necessary to stack two layers deep, they should be stood on end straight on top of each other. They will not be affected much by rain, provided air can circulate round them freely to dry them quickly. It is advisable to raise the surface where bags are to stand, or the bottoms may rot out if left long in position.

Careful consideration and actual practice of any or all of these suggestions will, it is hoped, tend to prevent leakages in the harvest.

Haymaking at the Hawkesbury Agricultural College.

GEO. COBB, Farm Foreman, and A. H. E. McDONALD, Experimentalist.

The quality of hay has such a determining influence upon the price which it brings, and can be so easily impaired by careless treatment, that every effort should be made to cure it in the best possible condition. Points which are essential are good green colour, and freedom from dirt, dust, and other rubbish. Good colour is of extreme importance, and a little attention to this detail often increases the value of the hay by 10s. or more per ton. The colour is chiefly dependent upon the stage of growth at which the crop is cut, and the weather conditions whilst it is drying. In very hot, dry districts the hay, whilst making, is likely to lose its green appearance and become straw-coloured, while in cool damp districts it may become a dirty brown. The best conditions are those where the weather is fine, with bright,

sunny, warm days. Such weather allows the curing to proceed evenly, the hay cures with a nice green tint, and the stem and leaves do not become hard and brittle. Very often the crop is allowed to become too mature, and is cut at a stage when it is more fitted for a grain crop than hay. The right time to cut is just after flowering, when the grain is about formed. It has then practically reached its full height, and very little increase in weight will be obtained by allowing it to remain uncut until a later period. Some men like to see grain in the chaff, but such chaff has no better feeding value than it would have had were it made from hay cut before grain had been produced. Grain is formed by drawing upon the nourishment in the stems and leaves, and when the crop is left uncut until grain is formed there is no increase in the feeding value, but rather a decrease, as the food materials are merely withdrawn from the stems and leaves and transferred to the grain. The ripening of the crop causes a change to take place in the stems and leaves, and a portion of the food material becomes less digestible, and, consequently, of lower feed-value. It also renders the hay less palatable, and when fed to stock without chaffing a considerable portion is rejected. When cut at the stage recommended, the stem is green, the hay very palatable, more digestible, and consequently more nourishing to stock.

Methods of Cutting.

The crop is cut either with the reaper and binder or with the mower, and the choice depends upon the size of the area, and whether the hay is to be fed whole or chaffed. If it is to be placed on the market as hay, it is necessary to cut with the mower, and this method is certainly preferable if the hay is to be fed on the farm without chaffing. If sheaves are fed to horses or other stock they merely eat the heads and upper portion of the stems, and reject the less palatable butts. When it is mown the hay becomes well intermixed, and stock cannot pick out the heads, and must eat the whole. It also has the advantage that, when stacked, it is not likely to be damaged by mice to the same extent as sheaf hay, as they cannot easily make their way through the tangled stems to the heads. When the hay is to be chaffed it is more economical to use the reaper and binder, as it is more easily and quickly handled. In some cases, however, when the crop is very thin, and less than 18 inches in height, the binder will not handle it, and the mower has to be used. Where the area to be cut is very small, and a reaper and binder or mower is not available, the crop can be cut with the scythe.

Care of the Reaper and Binder.

Before the crop is ready to cut the machine should be thoroughly overhauled, and any worn parts renewed. By doing this work early a good deal of vexatious delay will be avoided. It is most important that the knotter and connected parts should be carefully examined and tested. Derangement of these parts is a frequent cause of delay, and when they are working badly a good deal of time has to be spent in tying up loose bundles. Most of the trouble is caused by lack of knowledge of the parts of the tying

mechanism. Generally, binder twine is tested to stand a strain of 140 lb., but in many cases the tension spring is made too tight, and a strain of considerably over this amount is put on the spring, and, consequently, it breaks, and a loose bundle results. Some of the parts of the knotter become worn in time, and fail to do their work. The chief ones are the twine-cutting blade and the knotter jaw. The twine-cutting blade should be kept with a keen edge. The knotter jaw becomes worn after it has been used some time, through the friction of the string passing through, and does not allow the string to pass off freely, which prevents the knot being tied. It can be repaired by filing, but this is not altogether satisfactory, and the parts are so cheap that it is better to obtain new ones. Some of the parts are liable to fail unexpectedly, and duplicates of those likely to be needed should be kept on hand in case of emergency. A duplicate pitman is required, and it is necessary to keep duplicates of the parts which have most of the wear in the sheaf-tripping gear. These parts when worn fail to hold the sheaf, and the ejector arms continually revolve. The knife should be carefully sharpened before commencing. Several small machines, fitted with grinding wheels, are on the market for this purpose, and do the work satisfactorily. If one of these machines is not available, gaps should be removed with a file. A few blades and rivets should be kept to replace those which get broken. Only the best twine should be used; cheap twine is always unsatisfactory, as it is almost impossible to tie the sheaves sufficiently tight without breaking it, and the consequent additional labour more than counterbalances any saving which is made in buying cheap twine. Wear in the reaper and binder can be very largely prevented by careful treatment. All the bearings should be carefully oiled as often as necessary, and it has so many wearing surfaces that lack of attention to this detail will soon end in trouble. The canvases should be slackened, to prevent stretching, when the machine is not working, and should be removed altogether when the season's work is over, and stored in a place free from mice. The machine when in the field should be protected at night and during wet weather by a tarpaulin; when not in use it should be put away in a good shed. It is very frequently not the actual amount of work a binder does which puts it out of repair, but its exposure to all kinds of weather.

Care of the Mower.

The mower generally stands a good deal of rough work without much attention. The parts which wear chiefly are the pitman and the knife end. Duplicates of these should be kept on hand. The same attention should be given to the knife as advised in the care of the reaper and binder.

Cutting with the Reaper and Binder.

The machine should be regulated to make the sheaves such a size that they will dry properly. In heavy, sappy crops they should be made small. This is done by putting the compressor arm back into the last hole. Drying is facilitated in small sheaves, and there is less danger of the hay becoming mouldy inside if it rains. If the crop is light and, owing to dry weather,

does not contain much sap, the sheaves can be made the full size. The larger the sheaves are the less twine is required. Where short crops have to be handled the iron guide-strap should be placed in position on the platform, to enable the machine to carry the hay through. In commencing to cut, two rounds should be done right round the paddock. The sheaves which are thrown out against the fences should then be thrown in towards the crop, but not closer to it than 6 feet, and the machine taken round the outside in the reverse direction, to cut the crop left along the fences. A road of this kind should also be cut around crops which are to be left for grain, but only one round need be taken in each direction. At the same time, the paddock should be cut into convenient sizes for the stripper-harvester, by cutting across the paddocks wherever necessary. By doing this a good deal of hay is obtained, and a large amount of waste, which would occur through horses trampling through the ripe crop when stripping, avoided.

It is more difficult for the reaper and binder to handle short, thin crops than those which are short but thick, and if the soil is not sufficiently fertile, or the rainfall too scanty, to give a high crop, thick sowing is preferable for this and other obvious reasons. The machine should be set as low as possible, and to enable this to be done the land must be kept free from clods, stones, and sticks on the surface. Land should be always carefully cleaned when the crop is to be cut with mowing machinery. The machine has to be kept above all clods and stones, and if these are 5 or 6 inches high a considerable amount of valuable straw will be left uncut.

The only precaution which it is necessary to take in cutting is to see that no external moisture exists on the crop. If the sheaves are tied while the straw is wet with dew or rain, they are almost sure to mould on the inside. Generally, when one team is used, it is not safe to reckon on cutting more than 8 acres a day. If two teams are used, and worked in relays, 10 or 11 acres can be cut per day.

Stooking.

If the weather is fine, we find it an advantage to leave the sheaves on the ground until the following day before stooking. This allows the upper side to partially dry, and when the stooks are made this side is placed on the inside. Straight narrow stooks, containing fourteen to sixteen sheaves, are the best in damp districts, where the hay must have the benefit of all the sunshine. They should be made by working on each side, away from the centre. The sheaves should be well butted down and well pressed in at the top, and just slightly sloped towards the centre of the stook. If well put-up, the stooks will stand a considerable amount of rough weather without blowing down. In hot, dry weather the hay cures better, and retains a greener colour, if made in round stooks. Under such conditions less surface is exposed to the blazing heat of the sun, and the straw does not bleach so much, as when narrow stooks are made. They are generally made to contain fourteen to sixteen sheaves.

When stooks are well made the hay will stand a good deal of rain without harm. To protect it against rain, the practice is sometimes adopted of

capping the stooks. To do this the stooks should not contain more than ten or twelve sheaves. The sheaves for capping are placed on the stook butt upwards like an inverted V, with the heads projecting over the ends. We find that when the stooks are well made the benefits following capping are not sufficient to compensate for the extra time and work spent in putting them on. If the stooks are blown down before drying has been completed, they should be rebuilt. Continued wet weather wets the inside of the stooks, and they should be thrown down and remade on dry ground.

Drying.

The time it takes the hay to dry depends upon the weather and the condition of the crop. If the crop is light or has been allowed to become fairly ripe before cutting, if often dries sufficiently in five or six days, while sappy, heavy crops may require ten to fourteen days. In dry, hot weather heavy green crops usually take about twelve days, and in cool, dull weather from fourteen to eighteen days. It is difficult to state exactly the indications of sufficient dryness, and experience is the only true guide. Care must be taken that the crop is not too green, or it will sweat a good deal in the stack, and develop a bad colour. If, on the other hand, it becomes too dry, weight is lost and the feeding-value lessened. It is most important that no external moisture, either from dew or rain, is on the hay when stacking. The presence of this will cause the development of moulds, and the hay will come out of the stack musty, and, in some cases, absolutely useless for feed. It will also, in some cases, cause spontaneous combustion. This seems to be caused either by putting the hay in too green or too wet. To ascertain whether the drying has been sufficient, examine closely the interior of the sheaves, and especially the joints of the stems. The hay should feel slightly crisp, and not have a dead, damp feel. Sometimes the stems and leaves may appear sufficiently dry, but if the joints are examined it is found that they are still sappy. This is particularly likely to occur in hot, scorching weather. When the joints show a shrivelled appearance, the hay is fit to stack.

Cutting with the Mower.

As already stated, the mower is generally used for cutting crops which are to be put on the market as hay, or when a reaper and binder is not available.

Drying.

After the crop has been cut with the mower, it can be allowed to remain in the swath about half a day before raking into windrows. If it is light in character, the rake may be started almost immediately after the mower. Next morning the windrows should be placed into fair-sized cocks, made neatly, and kept high in the middle so that rain will run off. The length of time it takes to dry depends upon the weather and the nature of the crop, but generally in dry, fine weather, with crops of average quality, three to four days are sufficient. Care must be taken that the hay is not allowed to remain too long in the swath before raking, nor too long in the windrows before cocking, or the drying will be uneven and the soft, tender leaves will become very dry, while the stems are still green and sappy.

Cutting with the Scythe.

The scythe is only used where the areas are too small to warrant the purchase of expensive machinery. On many places, such as orchards and small mixed farms, oats or wheat can be raised to supply stock with the hay they require, and these small areas can be conveniently handled with the scythe. Skill in the use of this old implement has, through the introduction during recent years of cheap labour-saving machinery, become an almost lost art. Instructions as to its use are given in the *Agricultural Gazette* of March, 1906, and now reproduced.

The following extracts from the article which was written by Mr. Reid, instructor in gardening at the Hawkesbury Agricultural College, will, it is thought, be appreciated by many farmers with a limited area to cut for hay. Good service might also be done with the scythe on many holdings to clear out rank growths of grass, &c., in places inaccessible to the mowing machines or ploughs when making firebreaks.

Mr. Reid says: "Where it is intended to cut a crop of wheat or oats with the scythe, the direction of the ridges should be ascertained and followed. The direction and force of prevailing winds have also to be taken into consideration.

"A blade may be set to cut a light, medium, or heavy crop. It is generally recognised that the cutting edge should be a little elevated above the ground and above the back of the blade which sweeps along the surface. The cutting edge is thus placed in an oblique position against the stems of the plants, and it severs them with greater certainty, acuteness, and freedom than if the cut were horizontal.

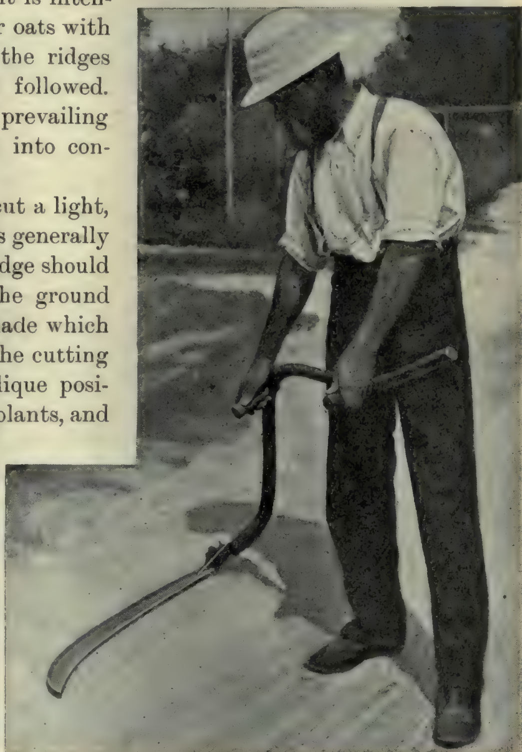

Fig. 1.—A medium-set blade for general mowing purposes.

"Fig. 1 shows a medium-set blade for general mowing purposes, and the attitude of the mower when cutting long grass, lucerne, barley, wheat, or oats. The sward of the average farm crop should be about 10 feet wide and of grass 8 feet.

"In Fig. 2 a demonstration is given of cutting an 11-feet sward of lucerne at the point of entering the crop. Note the position of the mower. Both arms are outstretched fully, with the swing to the right. The point of the

scythe blade must be in a straight line with the heel of the right foot. When the first movement is made, and on finishing the swing, the blade is in line with the heel of the left foot. The left hand, kept on the handle, must be opposite the left hip-joint and maintained firmly in this position during

Fig. 2.—The teacher showing how to take a 11-ft. sward—entering the full swing.

the progress of the blade in the swing round until finished. This position should be rigidly maintained. If it is allowed to get lower or higher, the point of the blade gets out of line and sticks in the ground, which may result

Fig. 3.—Finishing the full swing of a 11-ft. sward.

in snapping the point. If the left hand be permitted to extend away from the body, the blade will drag and fail to cut.

"The illustration No. 3 gives a view of the mower finishing the swing on a 11-feet sward, or completing the cut. Here we notice the handle of the

scythe and its relationship to the b›dy and heel of the mower. The mower's toe on the left foot is raised on entering the sward, and as the blade swings round the cut is finished with the toe raised on the right foot.

" After securing the correct idea of setting a scythe blade to meet the needs of the ground and crop, it is important to note that the handles are placed in correct position to ensure a well-balanced movement. In each case the handle for the right hand should be so transfixed and adjusted that, when taken up on the index finger, it will balance and hang evenly. To keep the blade in true cutting order, a scythe stone is used, and it is in these operations of sharpening proper dexterity is essential. A sharp, fine-grained stone should be selected. To sharpen the blade place the point in the grass on the left-hand side, grasp the heel firmly with the palm of the left hand, and with the right work the scythe stone, which is about 14 inches long. Make sliding strokes downwards on each side alternately with the stone.

Suitable positions in sharpening blades.

(Students at Hawkesbury Agricultural College.)

Keep it flat on the blade and avoid turning the edge. The last stroke of the stone should always be on the side which hugs the sward. When using the stone slide the hand half way down the blade and rest the elbow against the blade to keep it rigid. The sliding strokes downwards acts on the edge of the blade and converts it into a series of minute teeth like a saw and provides a keen cutting edge. The sharpening operation commences at the heel and proceeds evenly downwards until the point is approached; when the blade has to be raised and supported to sharpen the final few inches, the strokes are shorter and sharper with the stone. Care should be taken to effect sharpness on the point. Pass the thumb gently along the whole edge of the blade to ascertain if the edge be equally keen all through."

After cutting with the scythe, the hay should be allowed to remain a few hours in the swath, and then cocked. It takes the same time to dry as when cut with the mower.

Storing of Hay.

Every farm should have a good hayshed, and where hay is regularly raised for market it is economical to provide sufficient shed-room. Where sheds are available less care is needed in stacking, and the hay is thoroughly protected against all kinds of weather. It is better, because of the risk of fire, to have three or four small sheds, separated from each other, than to have one large one. Where sheds large enough to take all the hay cannot be built, at least one small shed is desirable. When stacks are opened up, either for chaffing or to obtain hay for the farm stock, it is difficult to protect the exposed surface, and loss is almost sure to follow. Where a shed is available, it can be kept filled by carting in the hay from the stack, as required. If the stacks are slightly smaller than the shed a whole stack can be carted in, and thoroughly protected from the weather. Such a shed is particularly desirable when chaff has to be cut during wet weather.

Sheds or stacks should be built as near the field as possible, so that valuable time will not be lost in travelling carts long distances from field to stack. A stack which holds between 30 and 40 tons is a very convenient size. The site should be well drained, and in such a position that a good road can be obtained right up to the stack. Much vexatious delay will occur in wet weather if the land around the stack is soft and boggy. A foundation of logs, straw, or some other material should be made for the stack, so that valuable hay will not be lost through damp. A site should be selected so that the drays can be unloaded from all sides. Tilting of a stack is often due to drays unloading in the same place each time.

The dimensions of the stack should be carefully considered before starting to build. This is especially necessary when only a small quantity of hay is to be stacked, as it may be found that, after work has been proceeding some time, the base of the stack is altogether too large, and that it cannot be properly completed. Rectangular stacks are the most suitable for hay. They have the advantage that when hay is required a portion can be pulled down without exposing the remainder of the stack to the weather. The weight of hay varies according to its condition, but if of good average quality about 500 cubic feet weigh a ton. A stack about 30 feet long by 18 feet at the base, 16 feet high from the ground to the eaves and 12 feet from the eaves to the top of the ridge, will, approximately, hold 30 tons. Such a stack should have a slope of about 2 feet outwards on each side from the ground to the eaves.

Carting.

When the hay is properly dry it must be got into the stack as quickly as possible while the weather is good. A fall of rain on hay after it is fit to come in does a good deal of damage, both to the appearance and smell. The rain washes off the downy substance on the outside of the hay, and as it is this which gives good hay its peculiar agreeable odour, its loss causes a deterioration in value. Drying of hay after it has been wet causes bleaching, and instead of retaining a desirable green colour it becomes more like straw. Even if rain does not fall, hay suffers in value if allowed to remain too long in the paddock after it reaches the desirable degree of dryness. The loss

in this case is through deterioration of colour and loss in weight. Two drays will keep one stack going where the hay has not to be carted very far. To work these, two men will be required on the drays, one in the field, and two on the stack. With good weather such a gang, in fair crops, will handle about 10 tons per day.

Stacking.

In building the stack it is essential to keep two things in mind—first, that the stack must be put up in such a way that water will run away from and not into the stack, and that the sides must be kept from slipping out. A layer of sheaves is laid right round the outside, keeping the butts in line, and when this is finished a second layer is started inside of these, keeping the butts of the second row about level with the bands of the sheaves in the first layer. The sheaves are laid in this way round the stack, gradually working in until the centre is completely filled, when a commencement is made again at the outside. When the sheaves are being laid they should all be well-kneed down to make the stack compact. Sometimes the outside sheaves are kneed down well, but those inside are simply thrown in loosely with the fork, and when the stack begins to sink the inside settles more than the outside, and causes the sheaves to slope from the outside inwards, and rain runs into the stack. By tramping the sheaves down tight throughout, keeping the centre high, and building from the outside inwards, the stack remains in the proper condition to throw the water outwards. The middle of the stack must be kept high, with a slope of about 1 in 3. As the stack is built upwards the sheaves should be kept outwards slightly, so that the sides will overhang a little and throw rain off. The sides of the stack should be kept trimmed by raking, and the butts beaten in to make them even. When the sides of the stack have been taken up almost sufficiently high, the last two layers of sheaves should be kept out a few inches beyond the general line of the sides, to form eaves. This will take the drip from the top clear away from the sides. After this, the stack should be carefully topped up by bringing each outside row of sheaves in gradually until the top is brought into a ridge. In doing this, the high middle should be retained, so that the sheaves will have a good slope outwards.

Carting and Stacking loose Hay.

Loose hay requires to be handled carefully when carting and stacking, to make the work as easy as possible. The forkfuls should be carefully lifted on to the dray, the pitcher practically placing them in the right position, and the stacker on the dray simply trims the load up and keeps the middle well filled. When unloading at the stack the hay is lifted off in forkfuls, as it was put on. In building stacks of loose hay, the outside must be kept even and the inside well filled and tramped down.

Thatching.

A great diversity of opinion exists amongst farmers as to the advantages of thatching. It is claimed by many experienced men that when the stack is well put-up it sheds the rain sufficiently, and that the benefits of thatching are not commensurate with the expense. On the other hand, many claim

that it results in the saving of a large amount of hay, and that, consequently, the work is profitable. Where the hay is only to be stacked a short time, and moderately dry weather is likely to prevail, it is probable that thatching will not be necessary, but where the stack has to stand through a wet winter, the work should be done.

Good clean straw should be selected, drawn out straight, and damped a few hours before commencing to thatch, to make it tough and easy to handle. A supply of small sticks from the bush, or short pieces split out of palings, and about 18 inches long, should be obtained. These are called "jims," and are used for fastening the thatch to the stack. They are all the better if a bit rough, as they are not so likely to pull out. Before starting, wind sufficient tarred rope-yarn or binder twine on fourteen to eighteen sticks to go half way round the stack. This yarn is used for tying the thatch to the stack. When starting, put the sticks with the string on them straight up the roof of the stack, about 12 inches apart, except the three top and three bottom ones, which should be about 6 inches apart. Commence thatching about the centre of one side of the stack, putting on layers about 2 feet wide and 3 inches thick, starting at the eaves and working upwards to the top. When the first layer or section is completed, remove the sticks with yarn on to the side next the ladder, and put permanent jims in the thatch near the edge remote from the ladder, commencing at the top, and tie the yarn on to these by taking two half-hitches round close to the top of the jim. The jims should be put into the roof at right angles, and no jim should be directly under the one above, or a small channel will be formed, through which water will find its way into the stack. Neither should the jims be placed in the thatch where one section ends and another begins. All the work must be done from the ladder, shifting it about 2 feet as each section is finished. When thatching the opposite side of the stack, a layer should be placed on top to overlap on each side, to form a ridge capping. A small hand-rake should be used to rake down each layer as it is tied on, so that no loose straw will remain on the thatch when finished.

A good idea of the market requirements for hay and chaff may be obtained from the following score-cards, in use at the College. The relative value of the various desiderata are clearly indicated:—

OATEN AND WHEATEN HAY.

Scale of Points.	Maximum Points.	Student's Estimate.	Instructor's Estimate.
1. Colour—Bright green preferred (according to market requirements)	16	....	....
2. Smell—Fresh, sweet, appetising; free from mustiness	20	....	....
3. Fineness of stem (for variety submitted)	8	....	....
4. Softness of stem, not harsh or brittle	12	....	....
5. Amount and quality of leaf	8	....	....
6. Amount and condition of grain (ripeness according to market requirements)	10	....	....
7. Cleanness—Freedom from dust, moulds, and impurities...	18	....	....
8. Weight and general make up for market	8	....	....
Total...	100	....	....

Harvest at the Hawkesbury Agricultural College.

1—Cutting. 2—Capping the stook. 3—Securing untied sheaves. 4—Carting, showing hay frames. 5 and 7—Stooking. 6—Unloading and stacking into shed.

In the Wheat Area.

1 and 2—Typical homes. 3—The fire-break cut for hay. 4, 5, and 6—By road and rail.

OATEN AND WHEATEN CHAFF.

Scale of Points.	Maximum Points.	Student's Estimate.	Instructor's Estimate.
1. Colour—Bright green preferred (according to market requirements)	12	....	....
2. Smell—Fresh, sweet, appetising; free from mustiness	20	....	....
3. Length and cleanness of cut	16	....	....
4. Fineness and softness (for variety submitted) ..	10	....	....
5. Amount and condition of grain (ripeness according to market requirements)	8	....	....
6. Proportion of stem to leaf	8	....	....
7. Cleanness—Freedom from dust, moulds, and impurities	16	....	....
8. Weight and general make up for market	10	....	....
Total...	100	......	....

HARVEST METHODS.

GEO. L. SUTTON, Wheat Experimentalist.

Preparing for the Harvest.

UNDER the best of conditions, harvest time must necessarily be a busy one. To minimise the urgent work inseparable from such a time, all that can be done in the way of preparation should be performed beforehand.

Implements and Machines.—The various machines and implements required should be overhauled and placed in thorough working order. Bolts should be tightened, broken or worn parts repaired or replaced, and bearings packed up so that pulleys and cogs will run in line; tarpaulins should be examined and repaired, and if necessary given a coat of mutton or beef tallow to increase their waterproof qualities. The leather belts should be thoroughly dressed once or twice with castor oil, to increase their gripping power and add to their life. If this dressing be done and the pulleys put in line, resource to resinous or other compounds during harvest will probably be unnecessary, provided the belts be cleaned regularly from dust. To put sticky mixtures on the belts, to cause them to grip, is an unsound practice. It affords temporary relief only, increases the draft, and is ruinous to the life of the belt.

If the crop or portion of it is to be stacked, suitable sites for the stacks should be selected, and if timber straddles are required, these should be obtained and carted to a convenient place, as also should any pegs that will be required for thatching.

Drays and waggons should be seen to and the hay-frames fixed. Hay ropes should be collected; and supplies of oil, black lead, bags, binder-twine, sections and rivets ordered, if not on hand.

Binder-twine.—In ordering binder-twine a good guide as to the probable quantity required is to estimate that a ball (4½ lb.) will tie about 2 tons of hay, or its equivalent of grain sheaves.

The Knotter.—The knotter of the binder should be examined and seen to that it is clean and bright; a rusty knotter is likely to cause untied sheaves to be thrown out, and a rusty needle is likely to break the twine. The knotter is the most ingenious and complicated part of the binder, and the one most likely to get out of order. Machinery experts now travel periodically through the agricultural districts, and it is advisable to get the agent or expert for the particular machine, when on the farm, to examine the knotter, and to have any repairs or adjustments effected which he may suggest.

Binder Knives.—Any badly worn or gapped sections in the binder knives should be replaced with new ones, and the smooth knives sharpened in readiness for the hay crop.

Ledger Plates.—The ledger plates in the fingers should be attended to; these to be in good order should not be rounded on the top edges. When in this condition they can be greatly improved by filing the edge straight and square, the filing to be done upwards and from the bottom of the fingers.

Getting the Binder ready.

The Knife.—To cut the hay crop, put in the smooth knife. This, if kept sharp, will cut a green crop better than the sickle, which should be kept for the grain crops.

The Reel.—To ensure the beaters of the reel working parallel with the fingers when in the crop, set them, when at rest with the end, near the outside grain divider, a little higher than the inside end, for there is always a tendency for the outside end to drop a little.

The Twine.—Place two balls of twine in the twine-box, joining the *inside end* of the bottom ball to the *end on the outside* of the top ball, with a reef or weaver's knot, and cut the loose ends off short. The balls of twine are made to unwind from the inside, and this arrangement allows the twine on the two balls to be used without a break. Draw out the end of the twine from the inside of the top ball and pass it through the opening in the box, thence to the tension spring and on to the needle, which should be threaded in accordance with the directions issued with the particular machine being used. If another ball be placed in the twine-box shortly after the top ball has been used, there will be no vexatious delays nor untied sheaves, as the result of the needle becoming unthreaded through lack of twine. It is to prevent these delays that the box is made to hold two balls of twine, and as far as possible two should always be kept in it.

The new ball is put at the bottom of the box, the one in use being put on top and the two joined together as previously directed.

The Tension Spring.—The tension spring should be screwed down just sufficiently to ensure that the sheaf is tied tightly, which should be done under all conditions.

Compressor-arms.—If the crop is a heavy one, adjust the compressor-arms so that the sheaf will be a small one, as this facilitates rapid drying and prevents the discoloration which would otherwise take place in the centre of large sheaves made from a heavy, rank crop.

If the crop be a light one, open the compressor-arms so that the sheaf will be a large one, as this saves twine.

Oiling and final.—See that all nuts are tight, that there is a fair tension on the link belts (these should not be too tight), and that all spindles or shafts are well oiled.

When oiling make it a rule to start oiling at one spot (preferably near where the oil-can is carried) and to oil the different parts in a regular definite order, going round the machine until the starting point is reached again.

A mixture of black lead and water, applied with a brush, will be found a better lubricant than oil for link chains, sprockets, and cog wheels; this will not collect dust like oil and so cause excessive wear, as the result of grinding.

Precautions against Loss by Fire.

Fire-breaks.—Hay-making affords a splendid opportunity to protect the crops, when ripe, from advancing bush fires, by surrounding them with a bare strip, which will act as a fire-break.

It is a fairly general practice in the grain-raising districts to cut a strip about half a chain wide around the standing crops for hay. Such a practice might be followed by all. It is a ready and economical way of safeguarding the ripe crop against destruction by fire. In large paddocks the practice might, with advantage, be extended to provide for the cutting of openings, half a chain wide, so as to divide the crop into blocks of approximately 200 acres each.

This is a ready and economical way of safeguarding the dry, ripe crop against destruction by fire. The piece of short stubble land provides a suitable place for checking the advance of a fire, which may have broken out in the grass paddocks or other portions of the crop. This is especially the case when, as at Iandra, a portion or the whole of strip of stubble is ploughed.

Fire-cart.—To assist in controlling or extinguishing a fire, should one break out, a fire-cart, filled with water and equipped with buckets, beaters, and axe, should be stationed, during harvest time, in a convenient place, with harnessed horses for drawing it, close by. On small farms where the number of horses is limited, the most suitable place for such a cart, is considered by Mr. P. Squire, of Yarra, to be at the winnower, or if the harvester is being used, at the place where the bags are sewn up. Stationed at such a place, it is where the men who are to use it can obtain it readily and at once.

It can be brought daily to such a place by some of the horses used in the stripper, and when required for a fire the animals necessary to draw it can be taken from the stripper or harvester working close by. There is an additional advantage in having it stationed at such a place, in that a small portion of the water in the tank can be used for giving the stripper horses a drink during the heat of the day. But care must be taken when such a plan is followed, that every favourable opportunity is seized to fill the tank, and that the quantity in it never becomes unduly low.

The Hay Harvest.

When to Cut for Hay.—The crop is at the best stage for hay when it is in flower. This condition is best, because at this stage the plant contains its maximum amount of nutritive qualities, and at the same time the nutriment is evenly distributed throughout the whole plant. This is as it should be for hay-making purposes, for when preserved as hay the whole of the plant is to be eaten and not a portion only, viz., the ears. It is, therefore, better that the whole of the nutriment should be evenly distributed throughout the plant, rather than one portion should be excessively nutritious, whilst the remainder is of little or no value as a food. Though the crop at the flowering stage contains the maximum amount of nutritive qualities, it has not reached the stage when it will produce the greatest weight of hay. The dry matter in the plant increases until it is mature; because of this, some farmers refrain from cutting the crop until it has passed the flowering stage, in order to get a greater quantity of hay. They gain the extra weight at the expense of the food value and colour.

The Machine to use for cutting the Hay Crop.

In the wheat districts the hum of the binder will announce the opening of the hay harvest. Except in a few instances, where the mower is used to make rack hay, the binder has superseded all other implements for harvesting the hay crop.

Cutting the Crop.

Starting.—Throw the machine in gear as the horses reach the crop and drive down and round the edges. Cut at least two rounds before attempting to cut the back swath or the piece knocked down by the horses.

The Butter-board.—By means of the lever, move the knotter to or from the butter-board as required, so that the sheaf will be tied in a position that it will be evenly balanced.

When the crop is very tall, and with machines that will allow it to be done, the mechanism operating the packers and supporting the butter-board should be adjusted so as to give as much room as possible on the length of the table.

The Reel.—Raise or lower the reel as the height of the crop requires.

If the crop is leaning away from the knife, put the reel forward, so that the beaters will be lifting the crop backwards when the knife reaches it.

In a short, thin crop the beaters should be low and well back over the table so as to prevent the stuff lodging on the knife or falling in front.

A very light Crop.—In a very light, thin, crop it is advisable to have the beaters right down on the fingers, so as to sweep the greenstuff on to the canvas. It is not possible to do this with the beaters as fitted to the machine, for these are made of wood, and therefore stiff and rigid, and in consequence cannot be set closer than 3 inches to the fingers, because of the ridge at the back of knife, which would break the beaters if struck by them when revolving.

The efficiency of the beaters for dealing with light crops can be very greatly increased by tacking or screwing leather on to the beaters, so that

the edge of the leather projects about 3 inches beyond the edge of the beater. As the leather is flexible the reel can be lowered until the edge of the leather touches the fingers; when the reel revolves, the leather, as it strikes the ridge at the back of the knife, will bend and pass over it without injury, and at the same time will sweep the short straws on to the canvas.

For a very light crop the binder may be further improved by inserting a piece of tin, or galvanised iron, under the first roller holder, and allowing it to project until it meets the clip on top of the fingers.

A light, thin crop can be cut better if rather on the dry side.

It may be thought that the mower will deal with a lighter crop than the binder, but it may be taken for granted that when a crop is too light for a binder, which is in good working order, to deal with, it is also too light for a mower to deal with profitably.

When the crop is too short for the mechanism to tie it in sheaves (and it is then so thin that if cut with a mower the rake would miss a great deal), it may be gathered in loose bundles by loosely covering the sheaf carrier with hessian.

This will carry the loose straws until enough are collected, when the trip can be released and the bundle deposited on the ground.

Laid and Tangled Crops.—Laid crops can only be dealt with by cutting them in the opposite direction to which they are lying. This entails working the binder only one way. When the crop is tangled as well as laid, considerable patience and judgment are required to make the most of such a crop. All that can be done is to drive the binder with care, seizing every opportunity to drive it against the direction of the majority of the laid plants.

Curing the Hay Crop.

Stooking.—After cutting at the right time, to secure the maximum food value the plant is capable of producing, it is essential that it be dried, and so preserved with as little loss as possible of this food value. Loss takes place as the result of rain washing out the sugar and other soluble food ingredients, and as the result of the heat and sun driving off the essential oils and other volatile compounds. To minimise these losses by protecting the sheaves from the action of the sun and rain, a considerable number are placed together in a stook.

The sheaves should be stooked without delay after they have been cut with the binder. The machine may be allowed to cut a couple of swaths, and then sufficient men should be employed stooking to keep up with the machine.

In a light crop, one man can stook the sheaves as fast as the binder can cut them, but in a 2-ton crop two men are not sufficient to keep pace with it.

The sheaves in long, open stooks dry more rapidly than in round ones, but in the former, more of the crop is exposed to the bleaching action of the sun. Long, open stooks are therefore suitable for moist districts, whilst the practice of making large, round stooks is adapted for the dry ones.

When to Stack.

Sheaves are allowed to remain in stooks until the hay is so dry that when placed in the stack it will not heat or mould. This stage is determined by drawing a handful of straws from the middle of the stook and examining the knots or joints in the straws. If these are dry the material can be stacked without danger.

Stacking.—For the hay intended for home use, shed room close to the stables should be provided; but hay intended for sale can, with advantage, be stacked in the paddock until required. This practice lessens the risk from fire, and reduces the cost of carting and other operations at harvest time.

Straddles.—Earth or clay straddles are better safeguards against rats and mice than timber ones, and when covered with a layer of straw or bushes are equally effective against damp.

Ensilage.

Now that the value of silage is becoming increasingly recognised, some farmers may desire to conserve a portion of their crop, particularly if heavy and rank, in this form.

The crop for such a purpose as for hay, should be cut when in the flowering stage. At this stage it contains about the right quantity of moisture for best results. Some farmers are under the impression that the crop for silage cannot be too sappy—this is a mistake. If the crop be immature or too sappy, it either will not conserve properly or it will produce ensilage of an inferior and probably of an objectionable character.

The reaper and binder will cut the crop, so that it can be handled most economically.

After being cut, the sheaves, instead of being stooked as when intended for hay, can be carted immediately to the stack, pit, or silo, and as they are stacked or otherwise dealt with, the bands should be cut to facilitate settlement.

The Grain Harvest.

For harvesting grain crops the reaper and binder, the stripper, and stripper harvester are used.

In moist districts the reaper and binder is used exclusively, for in such districts the grain in the standing crop is rarely hard and dry enough to be taken off with a stripper.

Over the greatest portion of our wheat area the conditions are, however, favourable for harvesting with the stripper, and the farmer in these areas has the choice of using either implement. Considerable controversy has waged about the advantages and disadvantages of harvesting with the respective implements.

As a cheap and rapid means of garnering the grain, the stripper is unexcelled; but against this, advocates of the reaper and binder point to the fact that the straw, or at least a portion of it, is wasted, and that what is saved is of lessened value. This is unquestionably true, but in connection with this matter, the fact that, after all, straw is a very inferior feeding

material must not be lost sight of. The cost of saving it is, in most cases, greater than its actual feeding value in normal seasons, and it is only by storing it until a very dry time, when inferior feeding materials have an abnormal value, that the farmer is able to recoup himself for the outlay connected with the saving of it. It is probable that the expenditure necessary for saving the straw, if spent in other directions, would have made more and better provision for times of scarcity.

Nor must it be forgotten that it is not necessary to waste all the straw if the crop has been stripped. If stock be turned on to the stubbles they will put them to good account without expense.

The question as to which is the more desirable implement will never be settled by argument. It is a question entirely of profit and loss, and the farmer who finds the stripper the more profitable, under his conditions, than the reaper and binder will use the former. This much is certain, that the stripper has played no mean part in the development of our wheat areas, and that but for it many acres now being profitably cultivated could never have been brought under the plough.

The modern stripper is a wonderfully efficient implement, and for harvesting grain cheaply is unexcelled. Australians should be proud that such an implement was produced and developed in Australia.

This implement is particularly adapted for our peculiar conditions, which necessitate that the individual cultivate a large area to be profitable.

The stripper and the harvester are intimately bound up with Australian agriculture.

When to use the Binder.—The crop is ready for the reaper and binder when the straw under the ears has turned yellow. At this stage the grain is waxy, and the crop may be cut without fear of loss. It is advisable to use the reaper and binder on the heaviest portions of the crop, and also on such portions, if any, which have become laid, for it is impossible to deal satisfactorily with such portions with the stripper. Even with the reaper and binder, care and trouble is necessary to gather all the crop.

It is probable that, when labour and other conditions allow, the up-to-date farmer of the future will commence his grain harvest with the reaper and binder, and complete it with the stripper.

Stooking and Stacking.

As fast as the crop is cut, it should be stooked just as the hay crop was stooked. Large round stooks will invariably be found the most suitable for dealing with the grain crop.

In the dry districts, if the threshing is to be done as soon as the grain is dry enough or as soon as the stripping is completed, the crop need not be stacked, but may be left in the stooks until required for threshing, and carted directly from the stooks to the thresher.

In districts where showers are frequent even during the summer months, or where dews are heavy, and in dry districts when the threshing is likely to be delayed, the sheaves should be carted and stacked as soon as they are sufficiently dry not to heat or mould in the stack.

The Stripper and Stripper-Harvester.

These machines will deal satisfactorily and economically with a wide range of crops, from the light one, 12 to 15 inches high, to the heaviest grown, except when such are laid and tangled. In such cases the reaper and binder must be used to make the best of a bad job.

The stripper-harvester is an improvement upon the stripper, and the natural evolution of that implement; in addition to threshing the grain as the stripper does, it cleans and bags it as it is being driven through the standing crop. In the hands of a careful man it is the more economical implement. Its mechanism is, however, more complicated, and a more skilful driver is required for the harvester in order to keep it adjusted properly, than for a stripper, which is comparatively a very simple machine.

For the man who works his own holding, or in districts where careful men are obtainable, who can be depended upon to attend to the proper adjustment of the wind-screen and riddles, the harvester will prove the most suitable and economical implement to take off the crop. On holdings where the crop is taken off entirely by hired labour, and where good and skilful men are scarce, a gang of strippers, feeding a power winnower, are likely to prove more suitable than harvesters. In the hands of unskilful or careless men the harvester is likely to get out of order, resulting in delay when time is most precious; or a large proportion of the grain may be lost as the result of adjustment of the machine not being properly attended to.

Bags.

The bags of stripped grain should be removed from the paddock as soon as possible. Whilst in the paddock the grain is drying and losing weight, and is in danger of being destroyed by fire. To minimise this, the bags should be stacked on timber at some distance (15 to 20 feet) away from the screenings, and with a space cleared of all stubble and rubbish, at least 12 feet wide, around them.

Saving Seed.

If, as should have been done, a portion of the crop has been specially planted for seed, this should receive prompt and special attention as soon as it is ready.

The grain intended for seed, before being harvested, should be allowed to mature, as far as the method followed will permit. If possible it should be protected brom bleaching or sprouting, and should be carefully threshed, whether with stripper or thresher, to prevent the germ being injured.

After threshing, the grain should be graded; this is especially desirable if the resulting crop is likely to be harvested with the stripper.

A noticeable feature of planting seed of mixed grades is the unevenness in the height of the heads, which means greatly increased work for the driver, if loss of grain is to be prevented.

If seed is scarce, the different grades can be planted, but each by itself. This plan is far preferable, and will be found more profitable than sowing the same quantity of seed of mixed grades together.

Practical Points for Stripper Users.

J. W. CHAPMAN, Foreman, Cowra Experiment Farm.

Preparing the Machine for work.

Preliminary Adjustment.—Though the final adjustment of some parts of the stripper cannot be done before the machine has been tried in the crop, much can and should be done some time before the crop is ready for stripping. The performance of this adjusting affords an opportunity to effect any repairs that may be necessary, to renew worn parts, and to obtain in readiness duplicates that may be required during the busy harvest time, when delays are not only dangerous, but likely to be costly. At the same time, supplies of oil for the bearings, black lead for the cogs and chain belts, and laces for the leather belts should be ordered if not on hand.

Lubricators.—See that the lubricating cups, with their syphons, are in order, and where possible have bottle lubricators fitted to facilitate even and constant lubrication. For lubricating the stripper a heavy oil is necessary, as thin oils in the extremely hot weather prevailing at harvest time run out of the bearings almost as fast as they are put in. The result is heavy draft, and hot boxes and spindles. Suitable oils for the purpose are very scarce, but too much trouble cannot be taken to secure a kind that is suitable.

The Fingers and Comb.—Some machines have combs with adjustable fingers, these should be set as close as the crop will permit (usually about $\frac{3}{16}$ of an inch apart), but wide enough to allow the knots in the straw to be drawn through them. If the fingers on the comb are fixed and worn, send the comb to a blacksmith to have the fingers closed and reset.

Beaters.—The beaters should be set low and near enough to the cutting plate to ensure the heads being cut off cleanly, and not drawn through the fingers. At the same time they should be set far enough back to drive the threshed heads on to the damp weather drum or into the box without choking or repeating.

Front Roller for Tall Crops.—If the crops are tall attach the front roller to the machine, and fix it so that the heads will be bent down low enough for the fingers to catch them, without taking in superfluous straw. If set too low, some of the heads will pass underneath the fingers, and be unthreshed and wasted. The final adjustment of this roller will require to be made after a short run in the standing crop. If such a roller cannot be fixed a similar result can be attained as the result of raising the body of the machine, by bolting blocks of wood the requisite thickness between the axle and the frame of the box, and by making obvious alterations to the connections between the winding-gear and the body of the machine.

Roller for Loose Ground.—For such occasions as when the surface of the ground is soft, and when the machine, instead of cutting off the ears and leaving the straw standing, pulls up the straw with the ears attached, prepare a roller the width of the comb and about 6 inches in diameter, and arrange for this to be attached by light chains to each side of the comb.

Such a roller can be made from a straight log, by driving a round pin with a good head into each end. The pins will revolve in split links, with which they can be attached to the chain, and which can be closed after being passed over the head of the roller pins. The chains should be long enough to allow the roller to go back until just under the wheels of the stripper. The adjustment of this roller can take place only in the field, and as the result of trial with the crop to be dealt with.

Removing Saucy Jacks, &c., from Stripper Comb.—To enable the driver to deal with the choking of the comb, with cobblers' pegs, Saucy Jacks, and other tall weeds, make a "spade" by attaching a piece of tin or galvanized iron, about 6 inches or 7 inches long by 4 inches wide, to a handle about $5\frac{1}{2}$ feet long, making a sort of small flag. Such a contrivance is shown on the front of the stripper in Fig. 1. With its aid a careful driver, without leaving his seat, can remove the weeds as they become entangled in the comb.

Emptying the Stripper.—For convenience in emptying the stripper when full, a two-handled scraper (as shown at the side of the stripper in fig. 1) should be prepared, and will be found very useful. This is made by boring two $1\frac{1}{4}$ inch holes in a piece of 6 inches x 1 inch hardwood about $3\frac{1}{2}$ feet long, or a little shorter than the stripper box is wide. Each hole is about 8 inches from the end and about $1\frac{1}{2}$ inch from the bottom of the scraper, as:—

Round sticks for handles, a little shorter than the length of the stripper box, are inserted loosely in these holes, and are prevented from being drawn out again by shoulders on the front, and by pins driven through the s icks on the opposite side of the scraper.

This scraper is placed in the stripper box when it is empty, with the board towards the front of the machine and the handles directed to the door.

When the machine is full and reaches the winnower, a man seizes hold of each handle and the machine is emptied rapidly, as in Fig. 3.

Using the Stripper.

Starting to strip.—When the crop is fit to strip, the grain if bitten will be found to be hard, and the heads of those varieties with pendant heads will hang down.

In a paddock which has not had the edges cut off for hay with a binder it is advisable to strip enough of the crop near the gate to admit of the winnower being set up.

The Winnower.—The winnower should be set solidly on the ground, and so placed that the wind blows from the fan and diagonally across the machine and away from the man feeding it. It should be turned at an even speed, and the tailboard set low enough to allow the chaff and cavings to blow over, but high enough to catch the white heads and grain.

1. Ready for work.

2. At work.

THE STRIPPER.

3. Emptying the Box.

4. Winnowing.

HANDLING THE STRIPPED GRAIN.

Starting the stripper.—When starting the stripper, grip the belt and pull it backwards so that the cog-wheels and beaters will come into rapid action immediately the horses start to move. Careful attention to this will minimise choking, prevent breakages, and save waste of grain.

Out of gear.—The machine should always be thrown out of gear when not working in the crop.

Method of stripping a paddock.—With the stripper, turning corners results either in missing a portion of the crop or in loss of time, as a result of performing an evolution resembling the figure 8. For this reason stripping around a paddock is not so economical of time as working in rather narrow portions, after the fashion of ploughing a paddock in lands. When this latter plan is adopted it is necessary to drive through the standing crop, and to have a portion knocked down by the horses walking through it. Though this portion can be stripped on the return journey some grain is lost, but this loss is more than compensated for by the extra amount of stripping done, as the result of adopting such a plan.

The middle of the day.—More and better work can be done with the stripper during the middle of the day than at other times, and for this reason such arrangements should be made that the stripper will not require to be stopped at this time.

Cracking the grain.—The final adjustment of the beaters, pulley and concave, can only be done after actual trial in the crop. The beaters by being driven too fast may crack the grain ; to remedy this reduce the speed of the beaters by putting a larger pulley in the spindle. For ease in draft the pulley in the beater-spindle should be no smaller than is necessary to thresh the grain out of the heads. It is generally necessary to use a smaller pulley in the morning than later in the day. When the grain is so easily threshed and brittle that reducing the speed of the beaters fails to prevent the cracking, the damp weather concave should be removed, and if this is still insufficient to prevent the cracking, the drum also should be removed.

Note on the Harvesting of Grain for the Mill.

F. B. GUTHRIE.

As nearly all the wheat harvested finds its way either directly or, through the shipper, indirectly to the miller, to be ground into flour, it seemed desirable to obtain some information from millers as to any points to which they consider special attention should be directed in the growing and harvesting of wheat.

With this object, I have approached several of the leading Sydney and country millers, and from information with which they have been good enough to supply me I have built together the following notes, which, I think, fairly represent their views on this subject.

They are fairly unanimous in the opinion that Australian wheat occupies a high place as a milling-wheat, chiefly on account of the ease with which it is milled and the excellence of its colour and flavour.

In the special quality of strength, which is an all-important point in determining the market value, and towards the improvement of which so much work is being done all over the world, the Australian product is still somewhat inferior to certain others; but I have shown that, as far, at all events, as New South Wales is concerned, there has been a steady and marked improvement of recent years.*

Improved machinery, both for sowing and harvesting, has also brought about a great advance, not only in the nature of the bagged grain, but in efficiency and economy in its preparation.

Relative Efficiency of Different Systems of Harvesting.

The use of the stripper is not in favour with millers, chiefly for the reasons—firstly, that the winnowing arrangement does not properly separate the chaff, short straw, stems, &c., a quantity of which finds its way into the bag and spoils the sample and necessitates the use of special machinery for cleaning it for the mill; and secondly, because of the risk of bleaching of the grain. One miller states, that before the advent of the stripper bleached wheat was unknown in Australia.

It is generally agreed that grain that has been reaped by the reaper and binder, and afterwards threshed, is a better sample and weighs heavier. This is largely due to the fact that the grain can be gathered just at the right time—that is, a little on the green side—and allowed to ripen in the stook, whereas the stripper is used when the grain is dead-ripe.

The danger of allowing the grain to ripen in the straw is, that if the weather is hot and dry the grain is liable to become pinched, lighter in colour, and of lower bushel-weight; whilst, on the other hand, if rain falls the grain becomes even more severely bleached, and very considerably deteriorated in milling-value.

There is also the danger of loss from shelling.

Another advantage of the separate thresher is that, being stationary, it can be fitted with more appliances for cleaning and grading than either the stripper or combined harvester, and can be run at a more uniform speed.

According to the opinion of one miller of experience, the chief disadvantage to the Australian system of harvesting is the length of time the grain is allowed to stand after it is ripe—sometimes two or three weeks.

The remedy is to use the reaper and binder and thresher, to harvest before the grain is dead-ripe, and to carry out the harvesting operations as expeditiously as possible.

It may also be desirable to sow such seed as matures fairly early.

Something might also be done in the way of sowing more than one variety, so as to avoid the whole crop ripening at the same time.

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* *Agricultural Gazette, N. S. W.*, March, 1909, page 247.

The combined harvester is a very great improvement on the old stripper, and this is probably the most efficient and economical machine at present available, and its introduction has greatly reduced the cost and labour of harvesting.

Some farmers object to the harvester on account of the danger of dirtying the ground; but this risk can be avoided by the use of the "chaff-carrier"—a large receptacle attached to the machine, in which all the screenings are deposited, so that weed-seeds are not scattered over the land.

Clean Crops.

Dirty grain is amongst the most common causes of inferior-quality crop. As far as the use of dirty seed is concerned, there is no excuse for the farmer to use it. The general use of the drill, indeed, is against its use, since the seed must be fairly clean and even in order to pass regularly through the drill.

The question of dirty ground is another matter, and one more difficult to guard against, since land becomes dirty in the most mysterious manner. The practice of growing the wheat crop season after season on the same land is a fruitful source of dirty land, since the wild oats and other foreign plants grow up with the wheat, and resow themselves before the wheat is harvested, so that in time, if the crop is not changed or the land fallowed—even in three or four years—there may be as much wild oats and barley as there is wheat; and such a crop not only produces grain of inferior milling value, but is of poor quality if cut for hay, producing chaff of second or third quality.

The farmer who allows his land to get foul not only spoils his own crop, but that of his neighbour, as the seeds get blown by the wind into other wheat-fields, and once firmly established are very hard to get rid of. As the oats and barley ripen earlier than the wheat, the seeds fall or are blown about before it is possible to reap them or remove them, except by hand.

The damage to the crop by rust or bunt or smut can only be guarded against by the farmer by selecting grain that has proved to be resistant to disease in his district; and this latter point is an important one, for a variety which has shown itself resistant in one district has frequently turned out to be very susceptible in another.

The practice of treating seed with formalin or bluestone, to minimise the risk of damage from smut or bunt, should be universal.

One miller even goes so far as to suggest that legislative action is desirable in order to make farmers keep their paddocks clean. Certainly it would not be oppressive to insist that if a wheat-field is so dirty as to be a menace to the neighbours, the owner should be compelled to cut it for ensilage when green, or feed it down with sheep before the oats and barley had a chance to ripen their seeds.

There would be no greater hardship entailed by this provision than, say, the uprooting of vineyards infested by phylloxera; and there might be a further provision that all wheat sold or used for seed-wheat should be first subjected to some authorised treatment for the prevention of bunt or smut.

D

Graded Grain.

In the same way, though it is, perhaps, too much to expect the farmer to grade his crop, he should at least grade the grain he uses for sowing. It has been repeatedly shown that the larger grains in the ear produces the most vigorous and prolific plants. It is, therefore, to the farmer's advantage to sow only graded and clean wheat.

The question of grading the crop simply depends upon whether the buyer will pay a sufficiently enhanced price for the higher quality and cleaner grain to recompense the farmer for his labour. Most millers would, undoubtedly, pay more for graded grain; but the buyer who buys on f.a.q. is prepared to pay as much for slightly inferior grain, provided it is not so light in weight or of such poor appearance as to reduce the average of his shipment below the standard. If buying on quality were universally adopted, it would undoubtedly have the effect of wheat being put on the market in better condition than it is at present.

The f.a.q. standard for buying undoubtedly encourages irregular quality and dirty condition of the wheat put on the market, since inferior wheat is often mixed with prime wheat and the whole sold as f.a.q.

This is also an argument in favour of fixing a standard for two or three grades.

Strong-flour Wheats.

The desirability of growing strong-flour wheats cannot be too strongly insisted upon. Other things being equal, this is the determining factor in the cash-value of a milling-sample; and this applies equally to wheat shipped to the English market and to that purchased for milling locally.

Thanks to the work of the late Mr. Farrer, there are now available varieties of wheat for seed purposes, suited to the different districts, which possess this quality in an eminent degree.

That this is a quality which can be permanently maintained locally has been proved by the experience of the last ten or twelve years. Strong-flour wheats yield well and maintain their strong-flour characteristics in districts which are as climatically different as the tablelands and the western plains. The cause of the higher value of such wheats as the Canadian wheats is not to be sought, as some have thought, in the fact that the ground is covered with snow for a certain time during the year, nor in the richness of the soil in humus and its higher proportion of nitrogen, as others have suggested; but it has been brought about by deliberate efforts at improving an introduced strong-flour wheat, and making it specially suitable to the district. This has been done for a succession of years in Canada, and No. 1 Hard has been at the top of the tree as a milling wheat for a long time. The same has been done in recent years in New South Wales, and the improvement in this matter of strength has been, though slow, distinctly marked. This has been strikingly shown in examining the wheats competing for prizes at the Royal Agricultural Society's Easter Show, in Sydney, for the past five or six years. As these are picked wheats, it would not be quite fair to argue

from their excellence as to the nature of the grain in general cultivation; but the important point is to be noted that the standard of excellence in the prize-wheats is steadily rising, and the danger of having to award the first prize to a sample deficient in gluten or strength is disappearing.

A fairer index as to the general improvement in this respect is afforded by a comparison of the strength and gluten-contents of the f.a.q. sample for the past few years. The following table gives the results obtained from the last four harvests:—

NATURE of Flour obtained from the f.a.q. sample in different years.

Harvest.	Strength. (quarts water per 200 lb. sack).	Gluten. (per cent.)
1905–06	45·5	10·2
1906–07	46·1	9·4
1907–08	48·5	10·6
1908–09	48·0	12·2

The high gluten-content of the present year's f.a.q. sample I am inclined to consider as exceptional, and that this increase will not be maintained. The gluten-contents of the 1908-9 harvest have been extraordinarily high throughout, especially in the drier districts, and is due to exceptional climatic conditions, such as rapid ripening, due to excessive heat and dryness at the time of harvesting.

Effect of Weather at Harvesting on Nature of the Grain.

A further point that must be taken into consideration, when harvesting, is the effect of weather conditions upon the nature of the grain.

Rapid ripening of the grain takes place when air and soil are hot and dry and the nights warm, and these conditions increase the gluten in the grain and, generally speaking, the flour-strength.

Provided the weather during the previous growth of the wheat has been favourable, hot and dry conditions at the period of harvesting are beneficial. When the opposite conditions prevail at harvest, that is to say, when air and soil are moist and cool, the result is a plump, soft, starchy grain, yielding a less glutinous and generally a weaker flour. When droughty conditions have prevailed during the winter and spring and the ears are not well-filled, rapid ripening results in a parched, shrivelled grain.

On the whole, the conditions that tend to diminish the quantity of the grain are those that are productive of a better quality.

Early Harvesting.

The question of harvesting at an earlier stage than is at present the custom, is one that is well worth serious consideration. It is by no means an easy matter to obtain reliable data on this subject, but the results of milling the same grain cut at different stages indicate that there is very little difference in the milling value of wheat cut in the dough or even in the milk stage, and in that of the same grain cut when ripe or dead-ripe.

This would point to the possibility of harvesting the grain at a much earlier stage than is now customary, thus avoiding the risk of unfavourable weather conditions at harvest time and the loss of grain that always results when it is allowed to get over-ripe, due partly to shelling and partly to loss on handling.

It would, of course, not be possible to use the stripper in these circumstances, and other questions, such as the quality of the straw and the yield of grain, would have to be taken into account.

At the same time, since dependence on the weather constitutes one of the main difficulties connected with the present system of harvesting, any modification which enables the farmer to choose the most favourable weather conditions is worth considering.

In the compilation of the preceding I am especially indebted to Messrs. Wise Bros., Jerilderie, Mr. J. A. Mitchell, of Henry Simon & Co., and Mr. Cadwallader, of Mungo Scott (Limited), for valuable suggestions and remarks.

Arsenate of Lead and Bordeaux Mixture.

Several inquiries have been made in regard to using arsenate of lead in conjunction with Bordeaux mixture for spraying purposes. The Chemist reports that the effect of mixing arsenate of lead and Bordeaux mixture would be to form sulphate of lead, which is a very insoluble lead salt. Any effect produced by the lead (and it is presumed there is some) would be lost.

If such a mixture is to be made it would be possible to use arsenate of soda, but, generally speaking, it is better not to depart from recognised and well-tried formulæ for spraying tender foliage and young fruit and wood.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1909.

Society.	Secretary	Date.
Adelong P. and A. Association	A. W. Molineaux	Oct. 5, 6
Bathurst Spring Horse Show	A. H. Newsham	,, 6
Menindie P. and A. Association	L. E. Underdown	,, 13, 14
Carrathool P. and A. Society	H. McMahon	,, 20
Horticultural Society of N.S.W. (Sydney)	A. W. B. Bradley	,, 21
Lismore A. and I. Society	T. M. Hewitt	Nov. 17, 18, 19
Tweed and Brunswick A. Society	F. A. Wildash	,, 24, 25
Berry Agricultural Association	C. W. Osborne	Dec. 8, 9, 10

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Agricultural Gazette of New South Wales.

Locusts in Australia and other Countries.

[Continued from page 772.]

W. W. FROGGATT.

Various Methods of Destruction.

IN dealing with the locust plagues in other countries the methods have been briefly noted; but in Australia, where labour is scarce and expensive, we will have to adopt the latest and most economical plans for getting rid of the plagues in our sparsely-populated districts. It is claimed in South Africa, where the locust is the most serious enemy that the farmer has to deal with, that spraying with arsenical compounds is the cheapest and most effective method that can be employed by the farmer. This consists of spraying the grass, edges of the crops, or dipping fodder in arsenical mixtures. Upon these the locusts feed, and die within a few days. The direct spraying is the most simple, for there is no preparation of food, and it has been found that arsenite of soda is effective and economical.

We have in Australia used a similar mixture in enclosed paddocks and gardens, but our landowners have always been afraid of the danger of any poison-spray upon the grass or herbage where stock is running, and as most of our paddocks are large it is not practicable to remove stock from the land until the arsenic is washed off by rain.

In the first report of the Committee of Control of the South African Central Locust Bureau, 1907, it is stated that no losses occurred among stock, because, wherever the spray touches, the grass is burnt up, and the stock will not eat it; that the rain washes it off, and that it can be easily burnt over after the locusts have been destroyed.

In the second report, 1907, from Natal, however, it appears that the danger of using arsenical sprays has been somewhat under-rated, as quite a number of stock have been poisoned, chiefly through getting at the poisoned material. In the third annual report (1909) additional information is given.

In a report, *Studies in Grasshopper Control* (Bulletin 170, Agricultural Experiment Station of the University of California, 1905), Mr. J. S. Hunter says he experimented with "Criddle Mixture," consisting of 2 lb. of salt, 1 lb. of arsenic, and 100 lb. of horse droppings, mixed with water. This mixture has been found very effective in Canada to poison locusts; but in California the locusts would not eat the preparation, and the results were practically nil, as it did not even attract the locusts.

He says: "Far different was the experience with the formula of grasshopper poison that has been used so many years in various parts of California. The proportions used were—

"Bran	40 lb.
"Molasses (cheap)	2 gallons.
"Arsenic	5 lb.

"This must be thoroughly mixed; and the strong-smelling molasses seems to be very attractive to the insects. This mixture, spread out on boards in orchards and gardens, attracted the locusts away from the foliage of the trees, and 75 per cent. of the locusts infesting one orchard thus treated died within twenty-four hours."

This is a mixture that can be used without a great deal of labour in destroying the locusts that invade an isolated orchard or garden, as is often the case in our Western districts. If the poisoned bran is placed on boards, when finished with they can be removed and destroyed, and there is nothing left in the orchard that can poison anything else.

Spraying with Soap, or Soap and Oil Mixtures.

Though these sprays are more expensive in the first instance than arsenical compounds, they have several advantages over the latter. First, there is no danger of poisoning anything feeding over the grass or herbage, nor any danger to animals getting at the mixtures while under preparation; and no danger to the men working the spray-pumps or mixing the materials, for handling large quantities of white arsenic produces sores upon the legs and arms, and might, perhaps, lead to worse evils.

Though it has been stated to the contrary, there is also the possibility of killing off animals and birds feeding over poisoned land.

We have carried out a number of experiments with both oil and soap washes, alone or combined, and there is no question about their effectiveness, particularly upon the very young locusts when they are massed together on the nesting-grounds.

Our formulæ are as follows:—

1. *Soap Emulsion.*

Hard soap (Sunlight brand)	1 lb.
Water	5 gallons.

The soap is thoroughly mixed with the boiling water; and in spraying over the young locusts they must be well wetted, so that the soap clogs their breathing organs, and so acts as a contact poison; the smaller the locusts the more effective, but well sprayed over them at this strength it will kill half-grown locusts.

2. *Kerosene and Water.*

Kerosene	1 gallon.
Water	7 gallons.

This can be used without any soap in spray-pumps that have an automatic mixer, and in these proportions of water and oil it will kill every insect it touches.

3. *Kerosene Emulsion.*

Kerosene	1 gallon.
Hard soap	½ lb.
Water	8 gallons.

These are mixed by dissolving the soap in boiling water, then adding the kerosene, and thoroughly mixing them together by pouring them backwards and forwards into a bucket, or with a garden syringe.

The relative cost of these sprays can be worked out by the current price of kerosene and hard soap.

In South Africa, with plenty of labour, they use small bucket-pumps, but in our work it is cheaper to use a large sprayer upon wheels.

It has been pointed out by landholders that any spraying is too expensive, and so it would be if they calculated it out at as so much per acre all over the estate; but it should be pointed out that when the locusts are massed together on the nesting-grounds, or just moving out, they can be all treated on an area of, perhaps, half a dozen acres, at about £2 10s. per acre—not a very big total to save later on thousands of acres of grass, not counting crops and gardens.

Trapping and Screens.

This is a method that was adopted in several of the Eastern countries, where the destruction or collection of locust eggs was also a recognised method, and where labour, often compulsory, was plentiful.

In the Island of Cyprus this was perfected by the British authorities, who adopted what was known as the Muttei method. These screens were comprised of rolls of hessian, 50 feet in length and about 2 feet 6 inches to 3 feet in height, stretched along on stakes driven into the ground, with the lower edges resting on the ground and a strip of oil or American cloth, 4 inches in width, stitched along the top edge, so that when the locusts crawled up the hessian and came to the oil-cloth they lost their hold and fell down, forcing each other into the pits dug along the line of hessian fence. It was found necessary to employ a man to go along the screen and wipe the oil-cloth with a sponge or rag dipped in oil, to keep it in a slippery condition.

These methods have been varied at times, by putting a sheet of iron or zinc over the pit, with the centre cut out, so that there is an overlapping rim on all sides, round which the young locusts cannot crawl.

If care is taken, the young locusts can be easily driven by a few men armed with a branch, but they must be worked from behind, and gently. The screen-and-trap method can be used in Australia to protect gardens, orchards, and valuable crops from hopping locusts until they are full grown, and even when they first move off and are flying low, but not when they are in full flight.

The Colonial Sugar Company found it profitable to adopt this method of screens and ditches to save their sugarcane at Childers, in Southern Queensland, some years ago (1904), when the large northern locust (*Locusta australis*) threatened their canefields. They also used molasses, into which they drove and smothered a great many of the young locusts.

At Victoria Mill, Queensland, in 1883, the locusts did much damage to the sugarcane. In the following season the cane-growers drove them into ditches, with overhanging sides and about 2 feet deep, which were dug round the camping places of the wingless locusts, and in these immense quantities were destroyed when they moved along in the morning.

From my observations and field experience, I am certain that it would often pay to use the screens to enclose the nesting-grounds, and then spray the enclosed hoppers when they have all hatched out, and the screens could be moved to a number of egg-beds one after the other.

Burning.

Under certain conditions it is possible to burn over the ground that is infested by the young locusts, but in extensive outbreaks it would be difficult. In local outbreaks, where they were coming into a crop or garden, straw was scattered round the fences, and when the locusts came on it was fired, and their advance checked.

Rolling, brush-harrows, and driving mobs of sheep over the young locusts are only temporary checks, and can only be attended with successful results under exceptional circumstances.

Many different machines and appliances have been brought out and patented for the destruction of locusts, for burning, crushing, sweeping, or collecting them. The most popular, and the only one that seems to be used to any great extent in the United States, is the "Hopperdozer," which is a frame of sheet-iron, with the back and ends turned up, the bottom forming a shallow dish about 2 feet wide and 10 to 12 feet in length, and with the front edge nearly level with the ground, like the sheaf-board of a reaping machine, but the edge is turned up a few inches and the bottom of the pan covered with kerosene or tar. Drawn against a moving swarm the locusts jump into this "Hopperdozer," and are killed by contact with the oil. If run on low wheels the body can be lifted off and emptied as soon as full. The smaller "Hopperdozers" can be drawn by hand, but the larger ones can be pulled along by horses, one at each side, and then the length of the "Hopperdozer" can be extended.

In rough ground where there are stumps, logs, and growing trees, all kinds of machines are at a discount.

When the Locusts are Winged.

When once the hoppers have emerged from their final moult and are winged, it is a very much more difficult matter to deal with them.

Birds may destroy numbers, and heavy rain and wind storms often help to kill them, but they are beyond spraying or poisoning, except in a limited way. When a swarm advances into a crop or garden, it has been found that smoke or a continued noise will frighten them away; and a few persons furnished with kerosene tins and sticks can thus scare them off.

It is not of much use poisoning an orchard or garden if the locusts have to eat all the foliage before they are killed; but if a plentiful supply of poisoned maize or other fodder that has been dipped into an arsenical

mixture be scattered round the headlands or under the orchard trees, it will sometimes attract them in time to save the plants and trees.

It has been suggested planting breaks of larkspur or castor oil plants along the edges of paddocks, because the foliage of both are poisonous to the locusts that devour them; but, supposing that the farmers would go to that trouble and expense, then both these plants might spread and become pest-weeds, for several species of the *Delphiniums* (larkspurs) are well-known poison plants to stock in the western parts of the United States.

Locust destruction in Hungary.

I am indebted to the Director of the Agricultural Experiment Station at Budapest, Professor Jablonowski, for the following information as to the methods employed in destroying the great swarms of locusts that lay waste the plains of Southern Hungary.

The Agricultural Department have had the machines, shown in the photographs, made for the special purpose of sweeping over and killing the locusts before they commence to fly. They have 400 machines, which cost £4 each, and they are sent down into the infested plains as soon as the young grasshoppers hatch out.

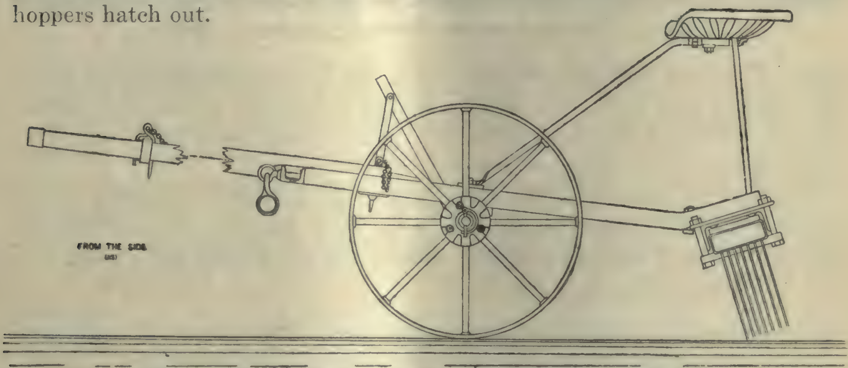


Fig. 1.—Hungarian sweeping-machine for destroying locusts (side view).

These sweeping-machines consist of a pair of wheels and a body, upon which the driver sits. On the back of this body, underneath, is a stout wooden bar, about 6 inches in width and 2 inches thick, extending the whole width of the machine, and projecting beyond about a foot on either side. This wooden bar carries on the underside a steel brush, formed of steel needles, inserted like the teeth of a hay-rake, only closer together, so as to form a regular brush, with teeth about 6 inches in length.

The front of the machine is fitted with a pair of shafts, wide apart. On the outside of each is attached a swingle-bar, to which the horses are harnessed as if to a pole, so that the space directly in front of the machine brush is clear. When they come to a locust swarm, the horses, being driven on either side, the young hoppers come directly under the brush, or, missing it, under the teeth of the next machine.

Six machines are usually worked together when the infestation is a serious one. The second machine follows behind, but just overlapping the track of the first, so that the six cover a large belt of land, sweeping every

Fig. 2.—Hungarian sweeping-machine, showing how the machine operates.

inch. Professor Jablonowski says:—"If the locusts are well advanced in size, but not able to fly, and the area of land infested of considerable extent, the machines are placed in pairs, and we have had seventy-two, and even more, machines working together at one time."

The work is always started on the edge of the plot, and the larval locusts forced gradually to the centre, and, when they are crowded together, the machines form a regular sweeping wedge, and the locusts are rushed over with the horses going at a trot.

Fig. 3.—Showing how the machines are driven in a set, one just overlapping another.

If the first sweeping does not kill all the locusts, the machines are turned, and the area is again swept with the steel brush. This method can only be carried out on flat, level meadow or pasturage lands; but this is where most of the locust swarms are found.

This method is found to be a very effective method of keeping the locusts under control in the kingdom of Hungary, where in ancient times they ate every green thing, and often caused a famine.

Some Practical Notes on Forestry Suitable for New South Wales.

[Continued from page 760.]

J. H. MAIDEN, Government Botanist and Director of the Botanic Gardens, Sydney.

XX (*continued*).

POPLARS.

"POPLAR trees differ from the Willows in having pendulous catkins, staminate flowers with from four to an indefinite number of stamens (some Willow flowers have as many as five stamens), and dry pollen. Moreover, the flowers have no nectaries, though they possess a hypogynous basin-like out-growth, which is regarded as either a disc or as a perianth.

"The Willow is insect-pollinated, whereas the Poplar is wind-pollinated. In accordance with these facts, we note that the catkins of the Willow are erect, its flowers produce honey, and its pollen is sticky. But the catkins of the Poplar hang loosely and are easily shaken by the wind; the flowers produce no honey; the pollen is dry; and finally the stigma, being lobed to a greater extent than in the Willow, it offers a larger surface for the reception of the pollen" (P. Groom).

The Poplars inhabit the boreal and temperate regions of the Northern Hemisphere. In America they range South to Northern Mexico and Lower California, where there is one endemic species (*P. monticola,* Brandegee), in the old world to Northern Africa, and the southern slopes of the Himalaya.

There are eighteen or nineteen species, but quite a number of hybrids, and most of them will grow in New South Wales, though a few species can be expected to succeed only in the very coldest areas of the State.

It is a very great drawback to acclimatisation work in New South Wales that, owing to the sparsity of our population, first-class nurseries do not exist in, say, Orange and Cooma, and plants raised in comparatively warm climates, and the progeny of plants perhaps thoroughly acclimatised to warm localities, are often sent to bleak districts, either to die, or to drag out a debilitated existence. But acclimatisation work is by no means at a standstill, thanks largely to the enterprise of private experimenters dotted over large areas of our State.

Populus is the oldest type of dicotyledonous plants yet identified, and its traces, with those of *Sequoias,* Pines and Cycads, have been found in the lower cretaceous rocks of Greenland. It was common on the mid-continental plateau of North America during cretaceous times, and in Europe and North America during the tertiary epoch, and predominated in the Miocene of Europe, the remains of twenty-eight species of that period having been described (Newberry quoted by Sargent).

"The wood of the Poplars contains numerous small, scattered, open ducts. That of many of the species is suitable for paper-making, and is used in large quantities in the United States and Canada for this purpose, and several species furnish wood that is employed in construction and in the manufacture of small articles, the most valuable timber-trees of the genus being the North American *Populus deltoidea, Populus heterophylla,* and *Populus trichocarpa,* the European and Asiatic *Populus nigra, Populus alba,* and *Populus tremula,* and the curiously heterophyllous African and Asiatic *Populus Euphratica.* The bark of *Populus* contains tannic acid, and that of several of the species is employed in Europe in tanning leather; in the United States, *Populus* bark, in which populin, a crystalline principle, occurs, is occasionally used as a tonic and in homeopathic practice. The fragrant balsam in the buds of several species, which is readily separated by boiling, is occasionally used medicinally as a tincture for its reputed tonic and stimulant properties, and by distillation yields a colourless oil of pleasant odour" (Sargent).

The manufacture of paper from poplar-wood pulp is becoming one of the foremost industries of Canada.

Poplar wood is often used as a substitute for better timbers, *e.g.*, a cheap grade is covered with a fine veneer of Cuban-cedar (*Cedrela odorata*) on the outside, and with paper on the inside for cheap cigar boxes (Gifford).

Many Poplars are valuable as screens and for wind-breaks, and the prevention of erosion, while they are useful for landscape work, either as single specimens or in greater profusion.

Brief Bibliography.

"Silva of North America" (Sargent).

"Practical Forestry" (John Gifford, New York).

"Manual of Indian Timbers," 2nd Edition (Gamble).

"Kew Hand-list of Trees and Shrubs Grown in Arboretum," Part ii. (1896).

"Select Extra-tropical Plants" (Mueller).

1. *P. alba, L.* The "White Poplar" or "Abele." Figured in *Eng. bot.,* ed. 3, t. 1299.

A tree sometimes nearly 100 feet high, with a trunk 3 or 4 feet in diameter, and light yellow-grey or ash-coloured bark, except at the base of old stems, when the bark is dark and deeply furrowed. It yields a useful softwood, but is chiefly employed for small articles, such as trays, bowls, and brake-blocks. It is used for wood-pulp.

It inhabits the borders of streams and moist open woods, spreading rapidly by its long, vigorous stoloniferous roots. Its habit of suckering is of course a drawback where single specimens are desired.

It is a native of England, Central and Southern Europe to Northern Africa, Western Siberia, Asia Minor, and the foot-hills of the North-western Himalaya, and has been largely planted in temperate countries, and does

The White Poplar (*Populus alba*).
Sydney Botanic Gardens.

well in the colder parts of New South Wales, in moist situations. It flourishes in Sydney, and a photograph is exhibited of one in the Botanic Gardens. It has been pruned several times to keep it within bounds, and this reminder is given—that our Botanic Gardens plants do not have the same chance to form fine specimens as where plenty of ground is available.

Garden Palace Grounds, near Government House Stables; M 26*; L 17 d.

2. *P. alba,* L. var. *Bolleana,* Masters (var. *pyramidalis* of the Kew List). (*Gard. Chron.,* n. ser., xviii, 556, f. 96, 1882.)

This is the most distinct variety of *P. alba.*

It has fastigiate branches, and was sent from Tashkend, in Turkestan, to Berlin, in 1875. It is now a common inhabitant of gardens, and it is the best White or Silver Poplar, in that it suckers less than the normal species.

* These numbers refer to the place of a specimen in the Botanic Gardens, Sydney. See the Official Guide.

3. *P. canescens,* Sm. The "Grey Poplar." Figured in *Eng. Bot.,* ed. 3, t. 1300.

A larger tree than *P. alba,* var. *Bolleana,* and with smaller, less deeply lobed, and darker leaves. It inhabits the same regions as the White Poplar (*P. alba*), and is equally abundant.

By some authors it is looked upon as a hybrid between *P. alba* and *P. tremula.*

4. *P. ciliata,* Wall. "Indian Poplar."

Native of the southern slopes of the Himalaya at an altitude of 4,000 to 10,000 feet.

It is a large tree, and its wood is used for cattle troughs. It is a substitute for the Poplar of Europe, but better woods are available locally.

Leaves used as fodder for goats. (*Gamble*).

5. *P. deltoidea,* Marshall. "Cottonwood." "Carolina Poplar." Figured Sargent, tt. 494, 495.

A tree sometimes a hundred feet in height, with a trunk up to 7 or 8 feet in diameter, divided often 20 or 30 feet above the ground into several massive limbs, which spread gradually, and becoming pendulous towards their extremities, form a graceful, rather open head, which may be a hundred feet across. Bark on trunk ashy grey.

Grows on the banks of streams from Quebec, through Western New England and New York, to Western Florida and Northern New Mexico. It thus has a very considerable climatic range, and will flourish in many parts of New South Wales.

Both in Europe and the United States it has been extensively planted in parks, and it is stated that no North American tree is more frequently planted in Europe.

Its timber is of inferior quality, seasoning badly, and its only use nowadays is in the manufacture of paper-pulp, for cheap packing-cases, and for fuel.

In Circular 77 of the Forest Service of the United States Department of Agriculture it is stated that:—"Paper pulp, box boards, backing for veneer, the unexposed parts of furniture, waggon boxes, interior woodwork and boarding, and fuel are the principal products for which the wood is used . . .

"Cottonwood is useful for protecting agricultural lands subject to annual overflow. A narrow belt of trees on the river side of such lands protects the fields from débris, and checks the erosive action of the water. Plantations of Cottonwood established on land between the river and the levee will not only protect the levee from damage by wave-wash caused by the wind, but will also give large commercial returns. It is also particularly adapted for planting along canals, since the roots do not grow into the water."

M 8; L 1.

6. *P. canadensis,* Moench. (*P. monilifera,* Aiton is a variety.)

7. *P. euphratica,* Olivier.

Believed to be the "Garab tree" of the Arabs, and the "Weeping Willow" of the Psalmist, upon which the Jews hung their harps. (Psalm 137). The "Bahan Poplar" of India.

A large tree, remarkable for the variability of the shape of its leaves, which, on seedlings, young trees, and vigorous shoots are linear, and on older branches broad and ovate, rhomboid, or cordate.

It inhabits the banks of streams from the province of Oran, in Algeria, through Egypt, Palestine, Syria, and Northern Persia, to North-western India and Western Thibet (where it ascends to 13,500 feet), Turkestan, and Southern Siberia.

In India the wood is used in turnery, in Sindh being made into boxes and lacquer ware; on the Euphrates it is said to be employed in boat-building, and in Sindh and Thibet it serves as fuel; the bark is employed as a febrifuge, and the twigs are used as tooth-sticks by the Hindus; the coppice-shots, which are produced for a long time with great vigour, are sometimes used for rafters. The leaves furnish forage for goats and cattle.

It is this tree and the Date Palm which are believed to have furnished the rafters for the buildings of Nineveh. It is still used for rafters in Kurdistan, the trunks being floated down the Khabour and Tigris (Sargent; Gamble).

8. *P. Fremontii,* Watson. "Western Cottonwood." Figured Sargent, t. 496.

A tree up to a hundred feet in height, with a short trunk 5 or 6 feet in diameter, and with stout, spreading branches, much like *P. deltoidea.*

This is the Western Cottonwood of the United States, and it lines the banks of streams over a large area of the drier, warmer Western States.

Splendid avenues of this tree adorn the streets and squares of the cities of Northern Mexico, where it has long been planted as a shade tree. For this purpose the male (staminate) trees are preferred, because of the seed-hairs of the other trees.

The presence of the Cottonwood indicates the existence of water to the traveller on the arid deserts of the Mexican plateau, and it might be a useful tree to add to the not very long list of trees which succeed on our Western Plains.

9. *P. monticola,* Brandegee.

The American representative of the old world *P. alba.* Often a hundred feet in height, with a tall, thick trunk; native of the cañons of the high mountains of the interior of Southern Lower California, following the dam toward the warm lowlands.

Unlike that of other Poplars, the wood of this noble tree is light red, hard and heavy, with a handsome satiny surface capable of receiving a high polish (Sargent).

This is a Poplar which will probably readily acclimatise itself in New South Wales.

10. *P. nigra, L.* "Black Poplar." Figured in *Eng. Bot.*, ed. 3, t. 1302.

A large tree of rapid growth, with erect, spreading branches. Distributed from Central Europe to Northern Africa, Persia, and Southern Siberia, and frequently cultivated in Britain and the United States.

The wood, which is soft, and splits readily, is largely used in Central Europe in making packing-cases, trays, bowls, dishes, and the soles of shoes. The bark is used in tanning leather, and that from the base of old trunks

Black Poplar (*Populus nigra*).
Sydney Botanic Gardens.

for the floats of fish-nets. The vigorous young shoots sometimes replace those of the willow in coarse baskets. The hairs which surround the seeds have been made into cloth, and utilised as a substitute for cotton in wadding-garments. Extracts of the balsamic buds have been used in medicine.

U 8 R; M 26; L 17. (See illustration.)

11. *P. nigra,* var. *pyramidalis,* Spach. (*P. fastigiata,* Pers. amongst others.) "Lombardy Poplar."

The most distinct in habit, and the most widely spread through cultivation of all the Poplars is the tree with fastigiate branches, known as the Lombardy Poplar.

It is believed that it originated in Afghanistan. It is cultivated in the valleys of the North-Western Himalaya, and ascends up to elevations of 12,500 feet in Western Thibet. Many people look upon Northern Italy as its place of origin; but this seems unlikely, and the subject is carefully discussed by Sargent, at "Silva, of North America," ix, 154.

Its singular columnar shape has caused it to be extensively planted in Europe, and very largely for avenues; but a tree so different in appearance from most other trees can readily be put in the wrong place, and there is no doubt that it has often been planted where it mars the landscape. At the same time, it is a valuable tree in the hands of a man with taste for landscape effects.

Gambie says its wood is made into grape-boxes by the Afghans, and the leaves are lopped for cattle-fodder.

Like the other Poplars, it does best in damp situations with good soil; but in New South Wales it would appear to stand most drought of all of them.

"In France cuttings of Poplars are stuck in the ground along streams and roads. In the course of a few years the side branches are cut off. They are tied into bundles and sold to bakers. They are in great demand, because they give a quick, hot fire, and produce a thick, rich crust on bread and pastry. In the course of about twenty years, these Poplars are cut down, and sawn by hand into boards, often by the very man who stuck the cuttings into the soil." (Gifford.)

U 8 R; L 2 c, 15 a, 17, 33 c. (See illustration.)

12. *P. tremula, L.* The "Aspen" or "Trembling Poplar." Figured in *Eng. Bot.,* ed. 3, t. 1301.

A tree 60 or 70 feet in height, with vigorous stoloniferous roots, smooth bark, slender branches, and small glabrous or pubescent, nearly orbicular leaves, which are borne on long, slender petioles, and flutter with the slightest breath of air.

It inhabits plains and mountain sides, usually with humid soil, from the Arctic Circle to Northern Africa, and from the Atlantic Ocean to Asia Minor, Northern China, Northern Japan, and Kamschatka.

In Europe the wood of the Aspen is used in the manufacture of matches and paper; the bark is employed in tanning leather, and the young shoots and leaves fed to cattle and goats.

13. *P. tremula,* var. *pendula,* Loudon. (*P. pendula,* Burgsdorf.)

A form of the Aspen, with long, pendulous branches, often cultivated in gardens in Europe and America.

14. *P. tremuloides,* Michx. "Aspen." "Quaking Asp." Figured Sargent, t. 487.

A tree often 100 feet in height, with a trunk exceptionally 3 feet in diameter.

Lombardy Poplar (*Populus nigra* **var.** *pyramidalis*).
Sydney Botanic Gardens.

This is the most widely-distributed tree of North America, ranging from Southern Labrador to Pennsylvania and Missouri, thence to the west in Central and Southern California, ascending to a considerable altitude.

It grows most luxuriantly near the borders of swamps and open forest glades.

"The great value of the Aspen lies in the power of its small seeds, supported by their long hairs, and wafted far and near by the wind, to be germinated quickly in soil which fire has rendered infertile, and in the ability of the seedling plants to grow rapidly in exposed situations. Preventing the washing away of the soil from steep mountain slopes, and affording shelter for the young of the longer-lived trees, it has played a chief part in determining the composition and distribution of the subalpine forests of Western America, and in recent years it has spread over vast areas of the slopes of the Rocky Mountains, from which fire had swept the coniferous trees." (Sargent.)

It in habit and general appearance resembles the old world *P. tremula.*

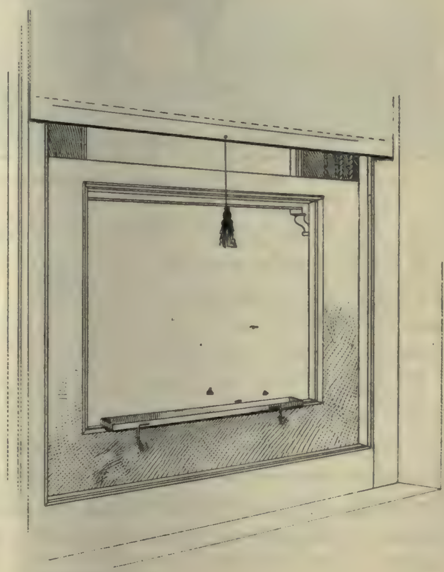
"A graceful tree, with its slender, pendulous branches, shimmering leaves, and pale bark, the Aspen enlivens the Spruce forests of Northern America, and marks steep mountain slopes with broad bands of colour, light green during the summer, and in autumn glowing like gold against backgrounds of dark cliffs and stunted pines." (Sargent.)

The American Aspen is, of course, capable of withstanding greater degrees of cold than we can present in Australia; but it would appear to be a useful tree for experiment around homesteads in the bleakest parts of the New England, to the Blue Mountains, and the Monaro; and from experience gained there, its further utility as a recuperator of bare mountain sides could be tested.

Destroying House Blow-flies.

Mr. G. A. Thorby, of Geurie, submits the following method of destroying blow-flies, which he has found very effective:—

Make a trough of any light sheet metal such as zinc, tinned iron, etc., about 1½ inches wide and ½ inch deep, any length necessary to fill width of window, with ends soldered in, and fix as shown in illustration.



Pour kerosene into this trough to the depth of about ⅓ inch. The blow-fly in his hurry hits the glass and manages before long to dip in the kerosene, which proves fatal.

In cases where the use of kerosene might be undesirable on account of its odour, it is possible that equally beneficial results may accrue from the use of strong fresh soapsuds or other lethal liquid.

TEFF GRASS.

IN 1907, seed of two varieties of Teff grass—brown and white—*Eragrostis abyssinica,* was obtained for trial at the different Experiment Farms.

In the first trial, both varieties did fairly well at Bathurst, Wagga, and Cowra, but the conditions were not satisfactory for a definite test. At the Hawkesbury Agricultural College, both varieties were sown in 1907 in small experiment plots of the grass garden. The season was exceptionally dry and hot, but, notwithstanding this, a good stand was obtained. In powers of drought-resistance, these Teff grasses compare favourably with Rhodes grass.

The Brown Teff attained a height from 18 to 24 inches, and seemed to be little affected by the hot weather. In this respect it stood out conspicuously among 100 other varieties of grass in the plots.

Brown Teff Grass at Hawkesbury Agricultural College Farm.

It came on early in the season, and produced a good bulk of herbage.

It forms a tufty growth, and stools out well from the centre. The stems are weak, and remain partly prostrate. Leaves are densely borne at the base, and extend well up the stems to the flowering head. The seed is produced freely, and is easily harvested.

White Teff also grew well and rapidly. It reached a height of from 18 inches to 24 inches, but was not quite so vigorous as the other variety, and was slightly longer in reaching maturity. It did not stool so freely, and the leaves and stems were coarser and not so succulent. The stools are spreading, and many of the stems are almost prostrate. The seed-heads are pinkish or reddish in colour before the seeds ripen. Seed was produced freely.

White Teff Grass at Hawkesbury Agricultural College Farm.

A further trial was made in 1908, and in summing up his opinion about these grasses, Mr. A. H. E. McDonald, Experimentalist at the Hawkesbury Agricultural College, says:—

Our experiments with these two varieties of Teff grass have been very successful. A fairly large area was sown on the 10th November, 1908, and although the weather was very dry for a considerable time after sowing, both grasses maintained a healthy condition, and when the rains of February came grew very rapidly. A cutting of each kind made on the 2nd March, 1909, a little less than four months after sowing, gave the following yields of green food per acre:—

White Teff	11 tons 18 cwt.
Brown Teff	9 tons 6 cwt.

There is no doubt that these are valuable, vigorous varieties. They seem to thrive well in poor sandy soil as well as in that of a more clayey nature, and to produce a large quantity of soft, succulent food. They remain green during the summer months, and make a second growth after cutting. They are annuals; but seed is produced very freely, and germinates easily, so that when they are given an opportunity readily reseed themselves. They are likely to prove very valuable as a rotation crop, as they do not occupy the land a long time, and could be grown in many districts in the summer-time to provide pasturage or to be used as hay, for which they seem to be very suitable. The results this year show that White Teff is the heavier yielder. It is somewhat later than Brown Teff in maturing, and the plot shown in the photograph now reproduced had during the last month of its growth an abundant rainfall. In the dry weather the Brown Teff seemed to be more vigorous. White Teff is taller and somewhat larger in the leaf and stem than Brown Teff.

Mr. R. W. Peacock, Manager of Bathurst Experiment Farm, reports:—

Seed of the two varieties was sown on the 25th November, 1908. They both made a vigorous growth throughout the autumn, and produced an abundance of seed of good quality; but ripening was uneven. These grasses appear to be annuals, and did not survive frosts.

Brown Teff is more vigorous than White. It grew to a height of from 30 to 36 inches, has erect habit, stools freely, with fine stems, and should be suitable for hay-making. The brown variety kept green much longer than the white. The latter has a more procumbent habit of growth, and coarser stems of about the same length as those of Brown Teff; but they ascended only about 12 inches. This particular habit may have been accentuated by allowing more room than in an ordinary pasture.

Chemical Notes.

Commercial Value of Some Waste Products.

F. B. GUTHRIE.

Manurial Value of Tobacco Stalks and Ash.

A complete analysis of the ash of a sample of tobacco-stalks was made by Mr. Cohen, in order to ascertain the amounts of fertilising material contained in it.

The analysis of the crude ash is given below :—

	Per cent.
Moisture...	1·66
Volatile and organic matter	2·61
Sand and insoluble	7·59
Oxides of iron and alumina (Fe_2O_3 and Al_2O_3)	1·50
Lime (CaO)...	22·44
Magnesia (MgO)	11·16
Potash (K_2O)	24·08
Soda (Na_2O)	6·63
Silica (SiO_2)	3·55
Phosphoric acid (P_2O_5)	5·33
Sulphuric acid (SO_3)	3·43
Chlorine (Cl)	7·98
Carbonic Acid (CO_2) by difference	3·84
	101·80
Deduct oxygen equivalent of chlorine	1·80
	100·00

The manurial value of these ashes calculated from the current unit-values of potash and phosphoric acid is £6 18s. per ton, and they are particularly rich in lime and potash.

The stalks themselves contain about 2·5 per cent. nitrogen, and yield 17·87 per cent. ash. So that 1 ton of ash is produced by burning 6 tons of stalks.

The fertilising constituents in the unburnt stalks are as follows :—

	Per cent.
Nitrogen	2·50
Lime ...	4·75
Potash	5·10
Phosphoric acid	1·13

The manurial value of 1 ton of the unburnt stalks will therefore be about £3 6s. 6d.

Consequently on burning the stalks and converting them to ash, 6 tons of the stalks, valued at £19 19s., will be converted into 1 ton ash, valued at £6 18s., the loss being due to the destruction of the nitrogen.

Whether it is more economical to use the stalks themselves as manure or to convert them first to ash will depend upon local conditions, such as the cost of burning, the nature of the soil, and the requirements of the crop. If applied unburnt the organic matter and nitrogen are saved, and the vegetable matter will form humus which may be of value to the soil. On the other hand the decomposition of the stalks is a slow process, and in this form the manure is a very slow-acting one in comparison with the more concentrated and soluble nature of the constituents in the ash.

The stalks will probably be best used as a mulch, or as a constituent of the compost heap.

Comparing the ashes with ordinary wood-ashes, the principal difference lies in the much higher percentage of lime and potash present (especially potash) which gives the tobacco-stem ashes a very much higher value as manure. These ashes contain nearly twice as much potash as is present in kainit, and nearly half as much as is in sulphate of potash. It is present principally as carbonate of potash, a very soluble salt, so that it is immediately available.

The ash of hardwood seldom contains more than 5 or 6 per cent. potash.

Tanyard Refuse.

An analysis of a sample of tanyard refuse recently submitted may be of interest as affording an idea of the general nature of this class of products, and its value as a manure.

The analysis was as follows :—

	Per cent.
Moisture	27·55
*Volatile and organic matter	44·73
Insoluble matter	2·12
Oxide of iron and alumina	2·20
Lime	19·00
Potash	0·68
Phosphoric acid	0·29
Undetermined	3·43
	100·00

* Containing nitrogen, 3·11 ; equivalent to ammonia, 3·77.

The substance has a value as a manure both on account of the nitrogen and of the lime which it contains. The high percentage of vegetable matter gives it a special value for soils poor in humus or as a top-dressing. Generally speaking its value would be greatest on sandy soils deficient in humus or inclined to be sour. The sample as submitted was coarse in texture, and its decomposition would be slow. It would be necessary to grind the sample finely, unless, of course, it is to be used as a mulch. In the finely-ground state its value would be about £2 5s. per ton.

Burnt Sheep Manure.

A sample of ash which had been obtained by burning sheep-manure was forwarded by a correspondent for analysis.

The figures obtained were the following:—

		Per cent.
Moisture		0·14
Volatile matter		5·63
Ash { Insoluble ...	75·10	94·23
Ash { Soluble ...	19·13	
		100·00

Analysis of crude ash:—

	Per cent.
Insoluble matter	75·10
Oxide of iron and alumina	2·38
Lime	6·40
Magnesia	1·13
Potash	7·94
Soda	2·84
Chlorine	3·02
Sulphuric acid	1·15
Phosphoric acid...	0·83
	100·79
Deduct oxygen equivalent of chlorine...	·68
	100·11

The analysis of this product may be of some interest, as it may occasionally happen that it is found of advantage to burn the manure. In its unburnt state sheep-manure contains on the average 30 to 40 per cent. dry matter, including the following fertilising ingredients:—

	Per cent.
Nitrogen	0·7
Potash	1·0
Phosphoric acid	0·5

The nitrogen is, of course, lost in converting to ash, but the resulting product has quite a high fertilising value, principally on account of the potash, which makes it worth about £2 per ton. It is, of course, not a complete manure, as it contains no nitrogen and very little phosphate, but its contents of lime and potash render it applicable in all cases in which wood-ashes are used. It is somewhat higher than wood-ashes in fertilising value.

Regulations in respect to the Analysis of Soils, Manures, Fodders, &c.

As it is found that the privilege conceded to farmers of having their products analysed by the Department is continually sought for by men of business and others not entitled to this concession, it is hereby notified that analyses for persons other than farmers can only be undertaken under exceptional conditions.

Attention is therefore drawn to the following Regulations:—

Regulations relating to Analyses performed in the Chemical Laboratory, Department of Agriculture.

ANALYSES of soils, fertilisers, fodders, plants, wheat, flour, water for irrigation or for watering stock, farm produce generally, insecticides, preservatives, &c., &c., are made by the Chemist gratis for *bonâ fide farmers and settlers, resident in New South Wales, only.*

No analyses will be undertaken for commercial purposes. These should be made by chemists outside the Department.

An exception is made in the case of manure manufacturers, or their agents, who wish to have analyses made of samples taken from bulk for the purpose of insertion in the annual list of fertilisers in the market published by the Department.

If it should be found that any farmer has taken advantage of the privilege of having gratis analyses made in order to have articles analysed for commercial purposes or for people not entitled to this concession, such privilege will be withdrawn from him, and he will no longer be entitled to have analyses made by the Department.

The Department reserves to itself the right of refusing to analyse any sample sent.

In cases where the Minister, after consideration, consents to an analysis being performed for persons other than farmers (with the exception mentioned above) a fee, payable in advance, will be charged as under:—

	£	s.	d.	
Manures—				
Blood, &c..	£2	2	0	each.
Bone-manures, meat and bones, &c.	3	3	0	,,
Mixed fertilisers	4	4	0	,,
Soils—Complete analysis	5	5	0	
Water, for irrigating or watering stock	2	2	0	
Milk, butter, cheese, &c.—Complete	2	2	0	
Wines—Complete	3	3	0	
Wheat—Milling sample	2	2	0	
Flour	1	1	0	

If complete analyses are not required, the analysis will be charged for at the rate of 15s. for each determination, but if only a single determination is made, this will be charged for at the rate of £1 1s.

Instructions for forwarding samples for analysis.

All samples should be addressed to the Under Secretary, Department of Agriculture, and be accompanied by a letter giving instructions and name and address of sender.

The sample should bear, either outside or inside the package, the name and address of the sender for identification. If more than one sample is sent in a parcel, they should be numbered or lettered, so as to correspond with the numbers, &c., in the letter of advice.

Soils.—Owing to the length of time required to carry out a satisfactory analysis of a soil, and the fact that there are a large number always waiting their turn, some delay is unavoidable in furnishing the result. If the results are required before carrying out any particular operation, farmers are advised to send in the samples about three weeks beforehand.

For the guidance of farmers in forwarding samples of soil the following directions are submitted:—

1. Dig holes in three or four places at fair distances apart to a depth of 18 inches or 2 feet. Clean out holes. Take a clean slice from each hole to the beginning of the subsoil, or to a depth of not more than 9 inches. Mix all well together, and of the mixture send a sample weighing 3 to 4 lb., including stones, fibres, and everything.
2. Send also a sample of the subsoil, 1 lb.
3. If the soil in different parts of the field is manifestly of different qualities, samples of each kind should be forwarded.
4. A rough sketch of the field, showing the spots where the samples have been taken, should be forwarded.
5. Forms of application for analyses of soil can be obtained from the Department.

The Chemist's technical report will be fully explained, and experiments in manuring, crops, and treatment will be suggested, based on the analysis regarded in the light of the detailed history submitted with it.

In forwarding samples mark each package with the name of the sender, and if more than one sample is sent attach a distinguishing number to each, corresponding with the number in the letter and sketch-plan.

Manures.—In forwarding samples of manure for analysis, great care should be taken to ensure that the sample sent represents a fair average of the bulk. In the case of a dispute between vendor and purchaser, the sample should be taken in the presence of someone representing the seller, or in his absence in the presence of a police officer. Three samples should be taken and sealed separately, one to be sent to the Department for analysis; the second handed over to the seller's representative or the police officer; and the third kept with seals intact for future reference.

A sample from ¼ to ½ lb., or even less, is sufficient for analysis, provided it has been properly sampled.

Plants should be cut close to the ground, the cut ends enveloped in sacking, and sent away immediately after packing. A box knocked together of loose boards, with interstices between the boards, is the best, as if packed in a tight box they are certain to sweat on a long journey. When sending plants or other perishable articles, such as milk, &c., for examination, a letter advising their despatch should be sent a few days previously, addressed to "The Chemist, Agricultural Department, Sydney," so that their analysis may be undertaken immediately upon arrival. The samples should be sent direct to the Chemical Laboratory, 136, George-street.

Waters for irrigating purposes and for stock should be collected in perfectly clean glass-bottles. Two ordinary quart-bottles will be sufficient. The bottle must be corked by a perfectly clean, well-fitted cork, and sealed. The bottles must, of course, be securely packed against breakage.

Wheat and flour.—For examining the milling qualities of wheat a sample of 1½ lb. weight is required. It should be stated whether the sample has been previously cleaned or not, and to what extent it has been cleaned. The name of the grain, if known, should also be supplied, as well as any information available as to the district, class of soil, yield per acre, &c. The Department does not undertake to name wheats from the grain.

Flour.—A sample of about ¼ to ½ lb. is required for analysis.

SUPPLY OF CULTURES OF NODULE BACTERIA.

DR. TIDSWELL states that cultures of nodule bacteria, prepared in the Bureau of Microbiology, have been distributed as under :—

Chief Inspector for trial in connection with farmers' experiments—cowpeas and table peas.

Bathurst Experiment Farm—garden peas.

Howlong Viticultural Station—garden peas, broad beans, dwarf beans.

Grafton Experiment Farm—common cowpeas, garden peas, butter beans, black Mauritius beans, common lucerne.

Glen Innes Experiment Farm—Algerian lucerne, broad beans, garden peas, cowpeas, white and yellow clover.

Wagga Experiment Farm—sweet peas, broad beans, garden peas, lucerne.

Wollongong Experiment Farm—garden peas, cowpeas, butter beans.

Mr. P. Waller, Drake—lucerne.

Mr. A. T. Wilson, Albion Park—lucerne.

Messrs. Gill Bros., Brooman—lucerne.

Mr. S. Hargrave, Walcha—beans, broad beans, peas.

Farmers' Calendar

[Continued from page 838.]

Seed Table for Farm Crops.

Crop.	Purpose for which grown.	Drilled. Distance drills apart.	Drilled. Quantity seed per acre.	Broadcast. Quantity seed per acre.	Period of growth of crop (approx.).	Notes.
					months.	
North Coast—Richmond-Tweed.						
Artichokes	Pig and cattle food.	3 ft. 6 in.	6 cwt. tubers	....	4–6	
Cowpeas	Fodder	2 ft. 6 in.	9 lb.	....	3½–4	
Cowpeas	Green manuring	....	....	40 lb.	4–6	
Field peas. (*See* "Oats.")						
Maize	Grain	4 ft. 6 in.	8–10 lb.	....	3–4½	
Maize	Ensilage or green fodder.	3 ,, 6 ,,	12 lb.	1½ bushels	2½–4½	
Millet	Green fodder	....	....	8–10 lb.	2	
Millet	Hay	....	....	8–10 ,,	3	
Oats	Green fodder	....	....	2½ bushels	3	
Oats	Hay	....	....	2½ ,,	5½	
Oats and Field peas	....	....	....	1½ ,, ½ bushel	2½–3	
Rye	Green fodder	....	....	1½–2 bush.	3	
Sorghum	Ensilage or green fodder.	....	....	40 lb.	3–4½	
Sorghum	Seed	3 ft.	6 lb.	....	4–4½	
Sugar-cane	Cattle food	4 ft. 6 in. to 5 ft. 6 in.	Sets 15 in. apart.	....	8	
Sweet potatoes	Pig and cattle food.	3 ft.	Sets or tubers.	....	4	
North Coast—Clarence-Macleay.						
Artichokes	Pig feed	4 ft.	6 cwt. tubers.	....	7	
Barley and Vetches	Green fodder	....	....	1½ bushels	3–4	
	,,	....	....	1 bushel		
Barley (Skinless)	,,	....	....	2 bushels	3	
Beans (Florida Velvet)	Fodder	4 ft.	15–20 lb.	....	6½	
Beans (Florida Velvet)	Pulse	4 ,,	15–20 ,,	....	7½	
,, (Mauritius)	Fodder	4 ,,	15–20 ,,	....	6	
,,	Seed	4 ,,	15–20 ,,	....	7	
Cowpeas	Green manure	....	....	40 lb.	4	
Cowpeas	Green fodder	2 ft. 6 in.	9 lb.	30 ,,	3½–4½	
Cowpeas	Seed	2 ,, 6 ,,	9 ,,	....	4½	
Flax	Linseed, for calves.	....	....	40–45 lb.	5	
Kale (Thousand-headed)	Fodder	4 ,,	1½ lb.	9 lb.	4	
Lucerne	Hay	....	....	15–20 ,,	First cut in about 4–5 months.	
Maize	Grain	4 ft.	12 lb.	....	5–7	
Maize	Fodder or ensilage.	3 ,,	24 ,,	1½ bushels	4½	
Millet (broom)	Broomheads	3 ,,	5 ,,	....	4	
,, (Hungarian)	Green fodder	....	....	20 lb.	2½	
Oats (Algerian)	Hay	....	....	2–3 bushels	5	
Oats and Peas	Fodder	....	....	1½ bushels	3–4	
	,,	....	....	1 bushel		
Paspalum	Pasture	....	....	8 lb.	6 (to establish).	
Potatoes	Market	2 ft. 6 in.	8–10 cwt.	....	4½	
Pumpkins	Pig feed	10 ft.	3 lb.	....	5	
Rape (Essex)	Green fodder	2 ft. 6 in.	2 ,,	8 lb.	2½	
Sorghum	,,	2½ to 3 ft.	8 lb.	30 ,,	4½	
Sorghum	Seed	2½ to 3 ,,	8 ,,	20 ,,	5–6	
Sugar-cane	Fodder	5 ft.	1,700 sets	....	8	
Swedes	Pig feed	3 ,,	3 lb.	....	4	
Sweet potatoes	Domestic use and fodder.	3 ,,	14,500 shoots	....	7	
Teosinte	Fodder	5 ft.	1½ lb.	....	5	
Wheat (Macaroni)	,,	....	....	1½ bushels	3½–4	

SEED TABLE FOR FARM CROPS—*continued.*

Crop.	Purpose for which grown.	Drilled. Distance drills apart.	Drilled. Quantity seed per acre.	Broadcast. Quantity seed per acre.	Period of growth of crop. (approx.).	Notes.
					months.	
Hawkesbury-Nepean.						
Barley	Greenstuff	7 in.	$1\frac{1}{2}$ bushels	2 bushels	3–4	Generally sown with peas.
Cabbages	Market	3 ft. x 2 ft.	7,260 plants	....	4–6	
Cowpeas	Greenstuff, ensilage, or hay.	2 ft. 6 in.	7–10 lb.	20–30 lb.	4–6	
Field peas	Greenstuff, with barley, oats, or wheat.	Drilled with cereal.	$\frac{1}{2}$ bush. peas, 1 bushel cereal.	Same as drilled.	4–5	
Lucerne	Greenstuff and hay.	....	....	12–15 lb.	First cut in about 5 months.	Permanent (3–6 cuttings per annum).
Maize	Greenstuff or ensilage.	3 ft. to 4 ft.	10–15 lb.	20–30 ,,	3–4	Keep cultivators going.
Maize	Grain	4 ft. 6 in.	6–8 lb.	....	4–7	Thin to about 12 inches.
Mangolds	Stock feed	2 ,, 6 ,,	7 lb.	....	7–8	
Melons	....	Hills 6 ft. x 8 ft. to 6 ft. x 10 ft.	2–3 lb.	....	4–6	Keep cultivated until runners cover ground.
Millet	Greenstuff, ensilage, and hay.	7 in.	6–10 ,,	10–15 lb.	$2\frac{1}{2}$–4	
Broom millet	Broomheads	3 ft. or 3 ft. 6 in.	5–6 ,,	....	6–7	
Oats	Greenstuff	7 in.	$1\frac{1}{2}$ bushels	2 bushels	4	
Oats	Hay	7 ,,	$1\frac{1}{2}$,,	2 ,,	5	
Potatoes	....	2 ft. 6 in. to 3 ft. 14 in. in row.	7–10 cwt.	....	5–6	
Pumpkins	....	10 ft. x 10 ft. to 12 ft. x 12 ft. hills.	2 lb.	....	5–7	Keep cultivated until runners cover ground.
Rape	Greenstuff	7 in. or 2 ft. 6 in.	10 lb. or 3 lb.	10–15 lb.	2–3 (2 or 3 cuttings).	Pigs or sheep may be turned into crop when 12 inches high.
Rye	Greenstuff	7 in.	$1\frac{1}{2}$–2 bush.	2 bushels	4	
Rye	Grain	7 ,,	$1\frac{1}{2}$–2 ,,	2 ,,	6	
Sorghum	Greenstuff, ensilage, and hay.	3 ft.	4–6 lb.	20 lb.	4–6 (2 cuttings).	
Swedes	....	2 ft. 6 in.	2–3 ,,	6 ,,	4	
Sweet potatoes	....	3 ft. x 2 ft.	7,260 rooted cuttings.	...	6–8	2 cwt. seed needed to produce the cuttings.
Tares. (*See* "Vetches.")						
Tomatoes	....	4 ft. x 4 ft. to 6 ft. x 6 ft.	2,745 to 1,210 plants.	....	4–6	
Turnips	....	2 ft. 6 in.	2–3 lb.	6 lb.	4	
Vetches (or tares)	Greenstuff with barley, oats, or wheat.	Drilled with cereal.	$\frac{1}{2}$ bushel, 1 bushel cereal.	Same as drilled.	4-5	
Wheat	Greenstuff	7 in.	1 bushel	$1\frac{1}{2}$ bushels	4	Bluestone and lime solution for bunt.
Wheat	Hay	7 ,,	1	$1\frac{1}{2}$,,	5	Bluestone and lime solution for bunt.
Wheat	Grain	7 ,,	$\frac{3}{4}$–1 bushel	1 ,,	6–7	Bluestone and lime solution for bunt.
South Coast.						
Barley	Green fodder	6 in.	$1\frac{1}{2}$ bushels	2 bushels	5	
Beans	Domestic	2 ft.	45 lb.	....	3	Cultivate lightly.
Beet or mangel wurzels	Fodder	3 ,,	6 ,,	....	6	Thin out to about 1 foot.
Clover	Pasture	....	....	12 lb.	5	
Cowpeas	Fodder	2 ft.	20 lb.	40 ,,	4–5	Cultivate until they run.
Grasses	Pasture	....	....	2 bushels	5	
Lucerne	Greenstuff or hay.	6 ft.	12 lb.	16 lb.	Permanent (first cut in about 5 months).	Free from dodder; cultivate freely after plants have taken firm root.
Maize	Grain	$4\frac{1}{2}$ ft.	9-10 lb.	....	6	Cultivate; for smut use bluestone, 2 per cent. solution.
Maize	Fodder	2 ,,	40 lb.	2 bushels	3–4	Cultivate freely.
Millet (Hungarian)	,,	6 in.	10 ,,	20 lb.	$2\frac{1}{2}$–3	
Oats	Hay	6 ,,	$1\frac{1}{2}$ bushels	$2\frac{1}{2}$ bushels	5	Harrow until plants are 5 inches high.
Onions	Market and domestic.	2 ft.	4 lb.	....	6	Cultivate freely; keep weeds in check.

SEED TABLE FOR FARM CROPS—*continued.*

Crop.	Purpose for which grown.	Drilled. Distance drills apart.	Drilled. Quantity seed per acre.	Broadcast. Quantity seed per acre.	Period of growth of crop (approx.).	Notes.
					months.	
			South Coast—*continued.*			
Peas (field)	Fodder	2 ft.	40 lb.	2 bushels	3–4	Cultivate between rows.
Potatoes	Market and domestic.	3 ,,	8 cwt.	....	3–4	Use formalin for scab; cut sets to two eyes; cultivate.
Pumpkins	Domestic	6 ft. x 6 ft. or 8 ft. x 8 ft.	2 lb.	....	5–6	Cultivate between rows until they run.
Pumpkins (cattle)	Fodder	6 ft. x 6 ft. or 8 ft. x 8 ft.	2 ,,	....	5–6	,, ,,
Rape	,,	6 in.	1 bushel	1½ bushels	4	Fit to graze in 6 to 8 weeks.
Rye	,,	6 ,,	1 ,,	1½ ,,	4	
Rye grass	Pasture	....	....	2 ,,	5	
Sorghum saccharatum	Fodder	2 ft.	12 lb.	40 lb.	5–6	Cultivate, and treat seed if smutty.
Amber Cane	,,	2 ,,	12 ,,	40 ,,	4–5	In case of weevil treat with bisulphide of carbon.
Imphee	,,	2 ,,	12 ,,	40 ,,	5–6	Cultivate freely between rows.
Planters' Friend	,,	2 ,,	12 ,,	40 ,,	5–6	Cultivate freely; treat seed as Amber Cane.
Tares or vetches	,,	2 ,,	40 ,,	2 bushels	4–5	Cultivate.
Turnips (Swede)	Cattle or pig fodder.	2 ,,	2 ,,	....	6	Cultivate, and thin out in rows.
Wheat	Grain or hay	6 in.	1 bushel	2 bushels	5	
			Northern Tableland.			
Barley	Grain	7 in.	40 lb.	65 lb.	6½	
	Green fodder	....	....	100 ,,	4	
Flax	Fibre	7 ,,	70 lb.	112 ,,	5–6	Harvest by pulling up by the roots when the stalks are beginning to turn yellow.
	Linseed	7 ,,	35 ,,	56 ,,	6–7	Harvest when seeds are well filled, plump and bright.
Grasses	Pasture	7 ,,	15 ,,	25 ,,	....	
Lucerne	Green fodder and hay.	7 ,,	8 ,,	15 ,,	2½	
Maize	Grain	4 ft.	8 ,,	....	5	Should have plenty of "field" to harden up well before being put into heaps; pull and husk in field.
	Ensilage	2 ft. 10 in.	32 ,,	56 lb.	3	
Oats	Grain	7 in.	40 ,,	60 ,,	6	
	Hay	7 ,,	60 ,,	80 ,,	5½	
Potatoes	Market	2 ft. 10 in.	7 cwt.	....	4	Gather early potatoes when of marketable size; for storing through winter, wait until haulms are quite dead, tuber firm, skin set.
Rye	Grain	7 in.	50 lb.	75 lb.	7	
	Green fodder	....	....	100 ,,	4	
Wheat	Grain	7 in.	50 lb.	75 ,,	7	
	Hay	7 ,,	70 ,,	115 ,,	6	
			Tamworth.			
Barley	Malting	7–8 in.	40–45	60	6–7	Excellent quality grown in district. Army cutworms principal pest.
Barley (skinless)	Greenstuff and grain.	7–8 ,,	40–50	70	5	Can be fed off two or three times, and then produce good grain crop.
Lucerne	Hay	....	....	12 to 20	4	Slow-growing until established; then can be cut up to six times a year.
,,	Seed	....	....	12 to 20	....	In most cases only one crop in the summer is allowed to ripen seed. Unless pods develop well, cut for hay.
Maize (large varieties)	Grain or fodder	3 ft. to 4 ft.	7 to 8 lb.	....	6–7	Rather an uncertain crop in parts of district. Sown in Sept. and October.
,, (small varieties)	Grain	3 ft. to 4 ft.	7 lb.	....	4–5	Sown in December and January.

SEED TABLE FOR FARM CROPS—*continued.*

Crop.	Purpose for which grown.	Drilled. Distance drills apart.	Drilled. Quantity seed per acre.	Broadcast. Quantity seed per acre.	Period of growth of crop (approx.).	Notes.
					months.	
Tamworth—*continued.*						
Potatoes	Market	3 ft. ..	5 to 6 cwt..	....	6–7.. ..	Many parts of district not adapted to this crop.
Pumpkins	Domestic use and fodder.	8 ft. to 10 ft.	1½ to 2 lb..	....	5–6.. ..	
Sorghum	Fodder	3 ft. to 3½ ft.	10–12 lb. ..	15 lb. ..	5	
Wheat	Grain	7–8 in. .	40–45 ,, ..	60 ,, ..	7	Many growers find feeding off in fine weather produces better results.
Central-western Slope.						
Barley	Grazing, greenstuff, ensilage.	6 in. to 8 in.	½–¾ bushel	¾–1 bushel	4–6.. ..	Fit to graze for greenstuff 6 to 10 weeks after planting. Will continue to grow after being cut or grazed.
Cowpeas	Grazing or greenstuff.	2½ ft. to 3 ft.	8–12 lb. ..	Not recommended.	3–6.. ..	After being cut or grazed cowpeas will continue growing until frosts set in.
Crimson clover	Grazing, greenstuff, or hay.	....	....	10–12 lb. ..	5–6.. ..	Continues growing until October.
Kale	Grazing or greenstuff.	2½ ft. to 3 ft.	1½–3 lb. ..	Not recommended.	4–6.. .	Available until October.
Lucerne	Greenstuff or hay.	....	....	8–10 lb. .	Perennial..	First cut 3 to 4 months from planting.
Maize	Greenstuff or ensilage.	3 ft. to 3½ ft.	12-15 lb. ..	Not recommended.	3–4.. ..	If birds are troublesome and destructive, dip seed in coal tar and dry with ashes.
	Grain	4 ft. to 4½ ft	8–9 lb. ..	,, ..	4–6.. ..	
Mustard	Grazing ..	2½ ft. to 3 ft.	3–8 ,, ..	5–6 lb. ..	3–6.. ..	Generally mixed with rape.
Millet (Hungarian) ..	Greenstuff or ensilage.	2½ ,, ,, 3 ,,	3–4 ,, ..	10–12 ,, ..	2½–3 ..	Makes a rough class of hay for standby purposes.
Potatoes	Domestic ..	2½ ,, ,, 3 ,,	8-10 ,, ..	....	3–4.. ..	Treat seed tubers for scab; 2 oz. formalin to 8 gallons water for 2 hours.
Rape	Grazing or greenstuff.	2½ ,, ,, 3 ,,	3–4 ,, ..	5–6 lb. ..	3–6.. ..	Fit for grazing 6 to 8 weeks after planting, and continues growing until September.
Rye..	Grazing, greenstuff, hay, straw, or grain.	....	....	½–¾ bushel	4–6.. ..	Fit for grazing 6 to 8 weeks after planting and until spring, when, if allowed to do so, it will run up and produce a crop of hay or grain.
Sorghum	Greenstuff, ensilage, or coarse hay.	3 ft. to 3½ ft.	3–6 lb. ..	Not recommended.	3–6.. ..	
Tares (or vetches) ..	Grazing or greenstuff.	2½ ,, ,, 3 ,,	12 lb. ..	30–60 lb. ..	5–6.. ..	Until end of October.
Wheat	Grain	6 in. to 8 in.	30–45 lb. ..	45–60 ,, ..	6–7.. ..	To prevent smut treat the seed with bluestone and afterwards with lime or formalin. If the soil at planting time is moist enough to germinate the seed promptly, formalin is to be preferred.
	Greenstuff, ensilage, or hay.	6 ,, ,, 8 ,,	30–45 ,, ..	45–60 ,, ..	5–6.. ..	
Tableland—Bathurst Section.						
Artichokes (Jerusalem)..	Tubers ..	2 ft. 6 in..	5 cwt. ..	...	7	Plant like potatoes.
Barley	Malting ..	7 in. to 8 in.	50 lb. ..	60 lb. ..	6	
	Green winter fodder.	7 ,, ,, 8 ,,	40 ,, .	50 ,, ..	5 (second growth, August till December).	
Canary grass	Bird seed ..	....	....	20 ,, ..	6	
Cowpeas	Grain	4 ft. ..	6 lb. ..	....	6	
	Fodder ..	2 ,, ..	20 ,, ..	....	6	
Lucerne	Hay	7 in. to 8 in.	6–8 lb. ..	10–15 lb. ..	Perennial summer crop.	

SEED TABLE FOR FARM CROPS—*continued.*

Crop.	Purpose for which grown.	Drilled. Distance drills apart.	Drilled. Quantity seed per acre.	Broadcast. Quantity seed per acre.	Period of growth of crop (approx.)	Notes.
					months.	
Tableland—Bathurst Section—*continued.*						
Maize	Grain	4 ft. to 5 ft.	7–10 lb.	....	6	Sow from 1 foot to 18 inches, in drills.
	Fodder or	3 ft.	8–12 ,,	....	6	
	Ensilage	4 ,,	7–10 ,,	....	5 (December till May).	
Melons	Market	10 ft. x 10 ft.	1–1½ ,,	....	5 ,,	
Millets	Grain	18 in. to 30 in.	8–12 ,,	....	7	
	Fodder	18 ,, ,, 30 ,,	8–12 ,,	....	6	
Oats	Grain	7 ,, ,, 8 ,,	40 lb.	50 lb.	8	
	Hay	7 ,, ,, 8 ,,	40 ,,	50 ,,	7	
Onions (from seed)	Main crop	15 ,, x 6 ,,	10–12 oz.	....	11	Seeds sown in beds to be transplanted.
Potato (from bulbs)	Domestic	15 ,, x 6 ,,	3–5 cwt.	....	6	Bulbs are planted.
Tree onions	,,	15 ,, x 6 ,,	¾–1 ,,	....	7	Bulbils from tops are planted.
Potatoes	Main crop	3 ft.	6–8 ,,	....	6	Plant 15 inches apart in drills.
	Early crop	3 ,,	6–8 ,,	....	4½	
Pumpkins	....	10 ,, x 10 ft.	1–1½ lb.	....	7	
Rape	Fodder to be cut.	2 ft. 6 in.	2–3 ,,	....	8	
	Pasture	2 ,, 6 ,,	3–5 ,,	4–8 lb.	....	
	,,	7 in. to 8 in.	4–5 ,,	7–8 ,,	8	
Rye	Grain	7 ,, ,, 8 ,,	40 lb.	50 lb.	7	
	Green winter fodder.	7 ,, ,, 8 ,,	40 ,,	50 ,,	5 (second growth till December).	
Scarlet clover	Pasture	....	....	8–10 lb.	7	
Sheep's burnet	,,	....	....	20 lb.	Perennial	
Sorghum	Grain	4 ft.	5 lb.	....	7	
	Fodder	3 ,,	6–7 lb.	....	7	
Tares	,,	2 ,,	20 ,,	30 lb.	7	
Tobacco (large varieties)	Leaf	4 ft. x 3 ft.	¼ oz.	....	6	For small varieties plant closer.
Turnips (Swede)	....	3 ft.	2 lb.	....	6	
Wheats	Grain	7 in. to 8 in.	25–30 lb. early, 35–40 lb. late.	35–40 lb. early, 45–50 lb. late.	8	
	Hay	7 ,, ,, 8 ,,	,,	,,	8	
Riverina.						
Barley	Grain	7 in.	25–30 lb.	60 lb.	5–6	
	Green fodder or silage.	7 ,,	35–40 ,,	60 ,,	3–5	
Barley and	,,	7 ,,	30 lb.	90 ,,	3–5	
Peas	,,	7 ,,	30 ,,	90 ,,		
Cowpea	,,	3 ft.	8–10 lb.	....	3–6	
Field peas	Green fodder	7 in.	60 lb.	60 lb.	4–7	
	Green manure	7 ,,	60 ,,	60 ,,	4–5	
Grasses	....	....	....	20–40 lb.	....	
Lucerne	Pasture	7 in.	4 lb.	10 lb.	Permanent	
	Hay	7 ,,	6 ,,	12–15 lb.		
Maize	Green fodder	3 ft.	25 ,,	60 lb.	4–5	
Millet	Fodder	7 ,,	8 ,,	10 ,,	3–4	
	Broomheads	....	8 ,,	....	4–5	
Oats	Grain	7 in.	25 ,,	40 lb.	5–7	
	Hay	7 ,,	30–40 lb.	50 ,,	5–6	
Oats and	Green fodder or silage.	7 ,,	25 lb.	65 ,,	4–6	
Peas		7 ,,	30 ,,	65 ,,		
Onion	Domestic	3 ft.	2 lb.	....	....	
Potatoes	,,	3 ft. x 15 in.	5–7 cwt.	....	4–5	
Pumpkins	Fodder	10 ft.	2 lb.	....	5–6	
Rape	,,	7 in.	3 ,,	3 lb.	....	
Rye	Green fodder	7 ,,	45 ,,	60 ,,	3–4½	
Sheep's burnet	Pasture	7 ,,	10 lb.	20 ,,	Permanent	
Sorghum	Green fodder	3 ft.	10 ,,	25 ,,	4–5	
Swedes	Fodder	3 ,,	2 ,,	....	....	
Tomato	Domestic	5 ft. x 5 ft.	1 oz.	....	....	
Turnips	Fodder & table.	3 ft.	2 lb.	....	....	
Vetches	Green manure	7 in.	30–40 lb.	60 lb.	4–5	
	Green fodder	7 ,,	30–40 ,,	60 ,,	4–6	
Wheat	Grain	7 ,,	30–40 ,,	60 ,,	6	
	Hay	7 ,,	45 lb.	60 ,,	5	

Artificial Incubation.

[Continued from page 417.]

G. BRADSHAW.

Evaporation.

HOWEVER uniform the temperature of the egg-drawer, and correctly gauged the moisture and ventilation may be, evaporation plays a very important point in the success or otherwise of hatching chickens by artificial methods.

The operator can usually obtain any temperature he desires, and without much effort keep it uniform, the great difficulty being some means of determining whether the ventilation is such that evaporation may not be too rapid, for if so the chickens dry-up in the shells, and hitherto there has been no practicable device to determine whether the eggs were too moist or too dry, the operator having only his experience as a guide.

To overcome this difficulty, there has for many years been published the chart which appeared in the May issue of the *Gazette,* which shows the size the air-cell should be during the currency of the hatch; but there is a good deal of guesswork in this, as one egg subjected a week to a given heat,

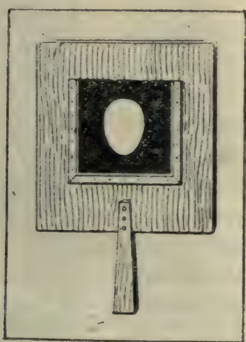


Fig. 1.
A Simple Egg Tester.

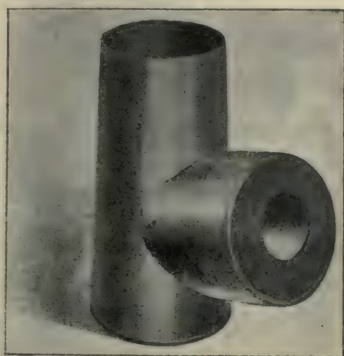


Fig. 2.
An Improved Egg Tester.

moisture, and ventilation, may, through a different degree of thickness in the shell, show a different sized air-space to another one in the same egg-drawer. Then, again, the air-space or cell may be correct according to the chart, and the chick die withal, either through the gases which are thrown off during the growth of the embryo not being carried away, or there may not be sufficient oxygen for the growing chicken.

The gases and moisture which are thrown off from the egg during the hatching naturally lessen it in weight, and this loss of weight corresponds to the stage of development of the embryo.

In a number of experiments made at some of the United States' Agricultural Colleges, but particularly at the West Virginia Station, results were considered so definite that the experimenters, Messrs. Atwood and Stewart, published the following table of directions, which should form a guide to those who care to test the development of the embryo:—

After placing the eggs upon the trays ready for the incubator, set the trays upon a pair of scales reading to ounces, and note the total weight of the eggs and trays. (The trays should be thoroughly dry.) After a few days weigh again. Subtract this from the first weight. This will give the actual loss in weight of the eggs.

Example.—Suppose that you have 208 eggs on the trays; that the first weight with trays is 24 pounds 2 ounces; and that on the sixth day the weight is 23 pounds 6 ounces. Then the loss in weight is 12 ounces. Now look in the table for the loss in weight of 100 eggs for six days. This is 10 ounces. Ten ounces multiplied by 2·08 gives 20·8 ounces, which is the calculated loss for 208 eggs for six days. Therefore the eggs have not been losing weight as rapidly as they should, and the eggs should be given more ventilation or the incubator should be removed to a drier location. (It is assumed that the eggs are kept uniformly at the proper temperature.) After the eggs have been tested for the infertile ones weigh again and proceed as before.

Rules.

If the eggs have *lost too much weight* give more moisture or less ventilation, but in reducing ventilation great care should be used, as pure air in the egg chamber is absolutely necessary.

If the eggs have *not lost enough weight* open the ventilators, or place the incubator in a drier place.

Table showing normal loss in weight of 100 eggs in ounces for the first nineteen days of incubation:—

1	1·65	8	13·44	15	25·66
2	3·31	9	15·16	16	27·44
3	4·96	10	16·88	17	29·21
4	6·62	11	18·60	18	30·99
5	8·28	12	20·33	19	32·77
6	10·00	13	22·10		
7	11·72	14	23·88		

The experiments on which the table is based was made by the natural method.

Eggs were weighed, placed under broodies in locations suitable for a perfect hatch, and weighed at intervals, and the loss determined. The tables of the experiments cover several pages, the conclusions being as follows:—

1. Fertile eggs, when incubated in a normal manner, decrease in weight.

2. The eggs which hatched lost 4 per cent. of their weight during the first five days of incubation. During the seven succeeding days they lost 6 per cent. of the weight of the eggs at the end of the fifth day, and during the next seven days lost 7 per cent. of their weight at the end of the twelfth day.

3. One hundred fertile eggs of average size will lose about 8 ounces during the first five days of incubation; 12 ounces, during the next seven days; and 12 ounces during the next seven days.

4. The infertile eggs lost 3·6 per cent. of their original weight during the first five days of incubation. During the seven succeeding days they lost 5·6 per cent. of what they weighed at the end of the fifth day, and during the next seven days lost 5·6 per cent. of their weight on the twelfth day.

One hundred infertile eggs will lose about 7 ounces during the first five days; 11 ounces during the next seven days; 10 ounces during the next seven days.

The decimals are omitted.

It has to be borne in mind that the experiments were made to assist the poultry-men in working incubators to the end of solving the dead-in-shell problem, which has long exercised the minds of manufacturers and operators.

The inference by the West Virginia Station was, that by observing the developing of the air-cell, and weighing the eggs, the injurious effect of too much or too little ventilation could be gauged and controlled, or, to put it in the words of the Station—

If the operator of an incubator knows how much a certain number of eggs have lost in weight since the beginning of the incubating period, and compares this loss with the normal loss of the same number of eggs for the same length of time, he will know definitely whether the eggs have decreased properly in weight. If they have lost too much, providing of course that the temperature has been normal, they are drying up too rapidly, and either more moisture should be supplied, or the amount of ventilation should be reduced, but in reducing the circulation of air through the incubating chamber it must be remembered that pure air surrounding the eggs is just as important as a proper temperature; on the other hand, if the eggs are not losing weight as rapidly as they should they are either kept too moist, or they are not receiving the proper amount of ventilation, or perhaps they may be kept too moist and insufficiently ventilated also.

There were three hens set, the first with ten eggs, the others with twelve and thirteen, respectively. Each egg was weighed separately daily, the

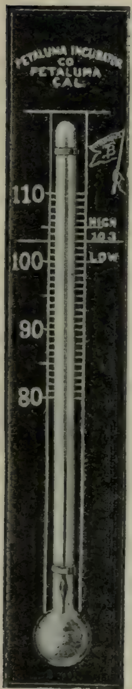


Fig. 3.

Types of Thermometers specially made for Incubators.

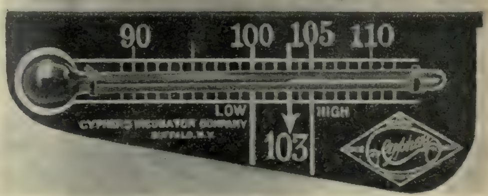


Fig. 4.

weight duly recorded, the irony of the thing being that, whereas the experiments were undertaken to discover some solution of the dead-in-shell in incubators, exactly the same thing took place with the hen. The first one, with ten eggs, eight proved fertile, and of these, two, or 25 per cent., were dead-in-shell, and failed to hatch, which is confirmatory of my contention in the earlier chapters on this subject, that when one or two eggs fail to hatch under a hen, little is thought of the matter, but when the same percentage takes place in a 200-incubator lot the machine is blamed, and various theories advanced as to the poor hatch.

The second hen experimented with broke one egg, and hatched the remaining eleven. Of the third hen's lot, two eggs were infertile, and, again, two fully-developed, but dead-in-shell, hatching nine chickens. All told, there were thirty-one fertile eggs, which produced twenty-six chickens, or under 84 per cent., a record which every incubator mentioned in this article has made scores of times.

The only remark made about those which failed to hatch, being—

The fertile eggs which did not hatch lost about the same amount of weight as the eggs which hatched. The dead chicks were perfectly formed, but for some unknown reason did not hatch.

This feature robbed the experiments of much of their anticipated value.

Cultural Methods for Wheat-growing in Dry Districts.

[Continued from May, 1909.]

GEO. L. SUTTON, Wheat Experimentalist.

II.

Successful modern methods require :—

1. That the land shall be fallowed in order that the water that falls may be stored, and to promote chemical and bacterial activity.
2. That the fallows be worked to aerate the soil, destroy weeds, and prevent loss and waste of moisture by evaporation.
3. That fodder crops be grown and consumed to maintain and increase the supply of vegetable matter in the soil, and to prevent depletion of fertility.

Suitable methods for giving effect to these requirements will be discussed *seriatim.*

Fallowing.

The primary and essential feature of fallowing is ploughing. This operation is the most important, and is the foundation of all our tillage operations. It should be done in a careful and thorough manner, for no amount of after cultivation can make up for the deficiences of slovenly ploughing.

Fig. 5 is an illustration of good ploughing, which in this case is also straight. It does not follow that ploughing to be good must be straight, but straight ploughing is the most economical, and it invariably follows that the man who is sufficiently skilful and interested in his work to plough straight, will do the best and most thorough work.

Figs. 6 and 7 are other illustrations of the ploughing operations, and show how the work is done economically on large farms with a different type of plough

So far, the results of the experiments carried out at Cowra and Coolabah on soil suitable for either type of plough, do not indicate that one type is more suitable than the other when modern methods of cultivation, of which fallowing is an essential part, are practised. This being so, the plough most suitable for the individual farmer's soil and location, and the one most in accordance with his individual taste, may be used for fallowing. It is, however, advisable to point out that the mould-board plough (Fig. 8) inverts the soil more thoroughly than the disc plough (Fig. 9), and for this reason, under circumstances when it is necessary to plough in a large growth of grass or weeds just prior to seeding, it is advisable to use the mould-board type.

The time to commence ploughing for fallowing will vary in different districts, but in a general way it may be said that the ploughing may

commence shortly after the planting operations are over, and should be completed before the hot, dry weather in the late spring makes the conditions unfavourable for such work.

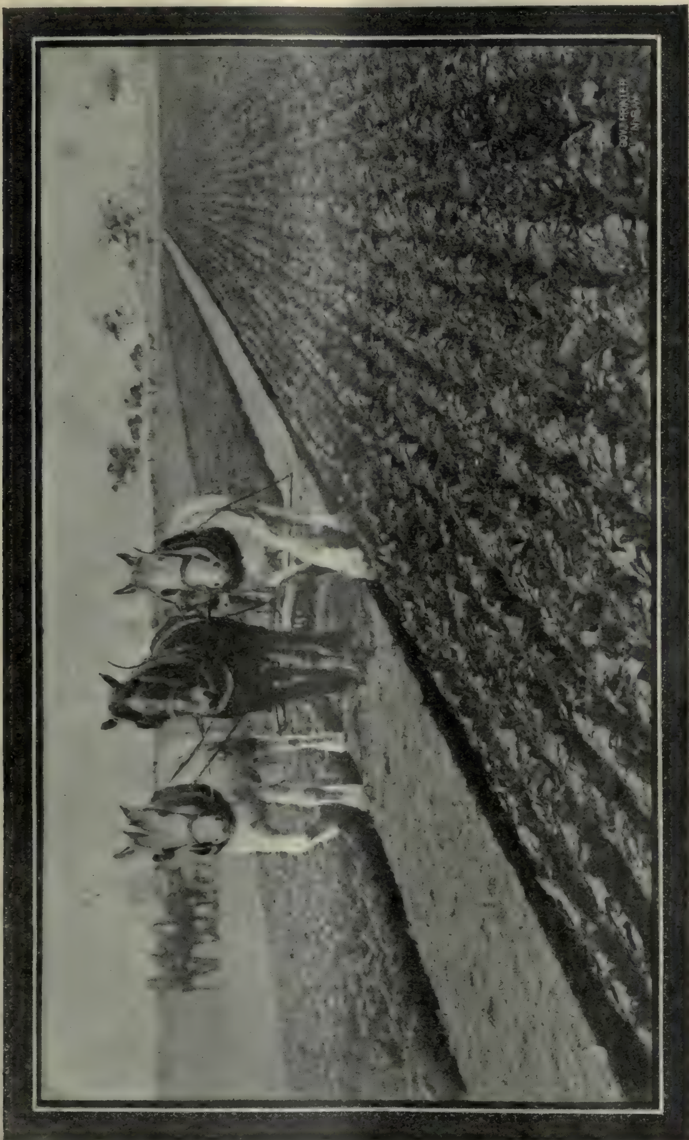


Fig. 5.—Good ploughing.

Winter and early spring is the season of the year when the work can be done most economically, for the weather is cool, and in consequence men and horses can work with the least amount of discomfort, and at this time the ground is generally in good order for ploughing.

The drier the district the earlier should the ploughing be completed.

The ploughing which is done at this season of the year, in addition to being thorough, may also be deep. There seems to be good reason to believe

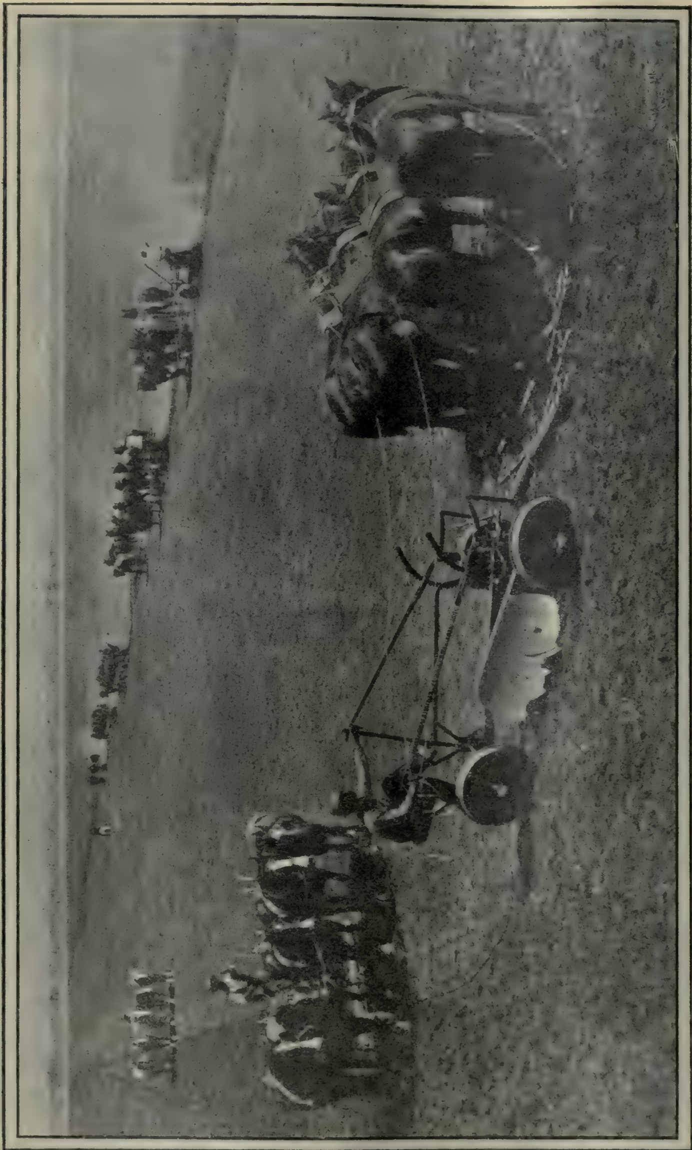


Fig. 6.—The disc plough on a large area at Narromine.

that the most economical depth to plough for fallowing is about 6 inches, but it may be deeper, if so desired; for though deeper ploughing and subsoiling has not so far proved profitable at Cowra and Coolabah, it has not proved detrimental.

Under the conditions prevailing in our wheat districts, it seems more necessary to plough thoroughly than very deeply. As this is not in accordance with the experience elsewhere, it may be that our experiments have not been conducted long enough to decide this point. There is no doubt

Fig. 7.—Disc plough at Wagga Experiment Farm.

that, under certain conditions, some soils will respond to deep cultivation, and in consequence, deep ploughing and subsoiling will prove profitable.

With some soils, as with sticky black soil, it may be necessary to plough them when they are wet, but the ploughing should not take place when the

Fig. 8.—Mouldboard plough.

soil is so wet either on the surface or beneath, that it is likely to be puddled. Ploughing under such conditions will nullify all the advantages which otherwise would be derived from early fallowing. Puddling injures the physical character of the soil, causing it to dry out and preventing a free circulation

of air, thus retarding rather than encouraging chemical and bacterial activity, which fallowing, when done properly, tends to bring about.

Though it is estimated that early fallowing will conserve in a season an amount of soil moisture equivalent to from 2 to 3 inches of rain, all the benefits obtained as the result of fallowing are not due to the extra moisture so conserved. Even when moisture is abundant, it will be noticed that the growth on unfallowed land is not as good as on fallowed land. This is because the chemical and bacterial activity present in fallowed land is very largely absent in unfallowed soil. As the result of chemical activity, brought about by the solvent action of moisture and the oxidising action of the air, the mineral ingredients of plant-food, potash and phosphoric acid, lying in an insoluble or dormant condition in the soil, and, therefore, in an unavailable condition for the use of plants, are rendered soluble.

As the result of the work of certain organisms, organic nitrogen (which is a form that cannot be made use of by plants) is transformed into the state of nitrate nitrogen, a form which is suitable for the use of plants.

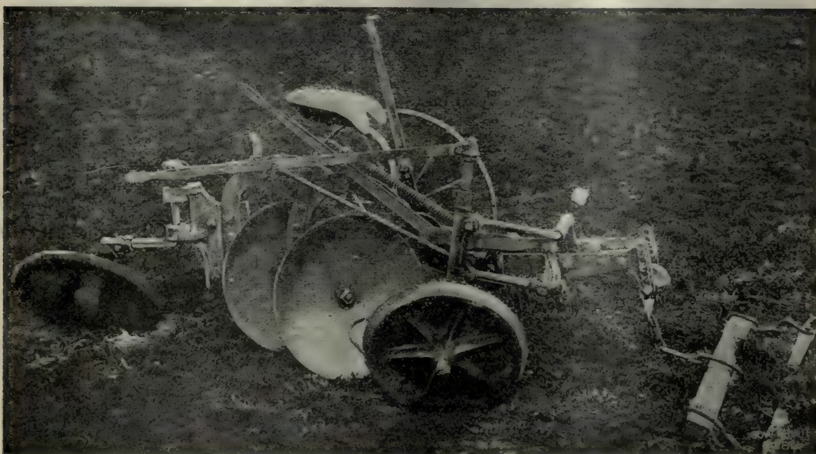


Fig. 9.—Disc plough.

Chemical and bacterial activity is only possible under conditions which permit of warmth, air, and moisture being present. Early fallowing brings about such conditions. Our climate provides the warmth, the ploughing aerates the soil, and working the fallows conserves the moisture.

There is now very little doubt that the benefits derived from early fallowing are largely due to the production of conditions favourable to the active growth of organisms in the soil, and it is now believed that these organisms are not only beneficial to, but absolutely necessary for plant growth. Biologists state that when the conditions are favourable there are something like eleven millions of organisms in a cubic inch of soil. The modern farmer will see that these organisms are working for his benefit by producing conditions favourable for their activity. As such conditions are produced as the result of fallowing, the conclusion is obvious.

Working the Fallowed Land.

Provided the soil has been ploughed when in good condition, it can with advantage be left in the rough state as broken by the plough; there is no necessity for immediate after treatment. But if the ground has been ploughed when wet enough for the furrow to show a large polished surface, it will be desirable, in most cases, to harrow it as soon as it is dry enough to crumble perfectly; otherwise it is likely to become so hard and lumpy that the labour necessary to make a good seed-bed will be largely increased.

The object of working the fallows early in the season, is to keep a mulch on the surface so as to conserve the moisture in the soil beneath. Mulches act by breaking the connection between the capillary power of the surface soil and of that beneath it. The more thoroughly this connection between the two sections is broken the more effective will the mulch be.

The plough, by cutting off a layer of surface soil and returning it loosely and more or less inverted, completely breaks the connection between the two sections, and in consequence makes a more effective mulch than any other implement. Recently-ploughed land is, therefore, covered with the most effective mulch possible. This is especially the case if a sod or the residue of a green crop has been turned under. Until this mulch has been destroyed by rain and other natural causes, nothing will be gained by working the land and breaking down the rough surface.

To do this will be rather a disadvantage; for it will have a tendency to reunite the connection between the surface soil and that beneath, thus strengthening its capillarity and increasing the flow of water upward to the surface, where it can be lost by evaporation.

Even if the ploughed surface has become somewhat settled, and therefore less effective as a mulch, little will be gained by working it in the early spring.

At this season, when the days are cool and often cloudy, and the amount of evaporation, even from damp soil, is not great, it would require almost continual stirring of the soil to maintain an effective mulch; for, owing to the conditions prevailing, the connection between the surface soil and that beneath would be united almost as fast as broken.

Later, after dry weather conditions set in, the amount of working the fallowed land will require will depend upon the climate and the condition of the soil.

If the moisture is to be saved the soil must be kept mulched. Professor King, of Wisconsin, found, as the result of experiment, that in seven weeks the loss of moisture from unmulched ground was equivalent to 170 points of rain more than from mulched land.

But if this moisture is to be conserved, the soil must be stirred as soon as the effectiveness of the mulch is destroyed by rain; for a mulch is only effective when loose and dry.

Even a light shower is sufficient, under some conditions, to render a mulch non-effective; and when this is the case the soil is often drier twenty-four hours after the shower than if no rain had fallen. This is due to the

increased capillarity of the particles, caused by the wetting and consequent compacting of the soil, resulting in loss of subsoil moisture by evaporation. This is illustrated by the results of an experiment conducted by Professor King, of Wisconsin.

From two adjacent plots (I and II) of ground samples of soil were taken, and the moisture content (a) of each plot determined. Plot I was then wetted with 1·33 lb. of water, equivalent to a shower of 25 points. Twenty-four hours afterwards the moisture content (b) of the two plots was again determined. It was then found that the moisture content of Plot I had increased by a total of 6·23 lb., and that of the untreated Plot II by 1·21 lb. This latter amount may be taken as the increase due to the natural capillarity of both plots.

The total gain of the wetted plot was 6·23 lb.; and as 1·33 lb. had been added, the gain due to capillarity was 4·90 lb. From the trials with Plot I the gain due to natural capillarity is known to be 1·21 lb. Therefore, the

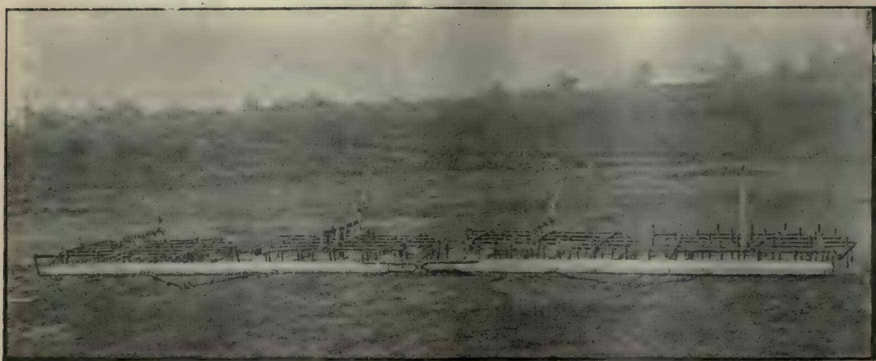


Fig. 10.—A set of harrows for stirring the surface of fallowed land.

gain due to vigorous capillarity induced by the wetting was 4·90 lb. − 1·21 lb. = 3·69 lb., which was equivalent to 70 points of rain.

The tabulated results of this experiment are as follows :—

Pounds of Water per cubic feet of wet area.—(I.)

	First foot.	Second foot.	Third foot.	Fourth foot.
(a) Before wetting	11·78	15 79	14·73	14·03
(b) After wetting	14·06	17·52	15·58	15·40
Gain	2·28	1·73	·85	1·43

Total gain = 6·23 ; water added = 1·33 ; net gain = 4·90

Pounds of Water per cubic feet of area not wet.—(II.)

	First foot.	Second foot.	Third foot.	Fourth foot.
(a) First samples	12·38	17·05	14·92	14·48
(b) Second samples	12·75	17·72	15·40	14·17
Gain	·37	·67	·48	·31

Total gain ... ... 1·21 lb.

Gain due to vigorous capillarity caused by wetting, 4·90 − 1·21 = 3·69 lb. = ·7 inch.

No hard and fast rule can be laid down as to the implement to use for working the fallowed land. The farmer will be guided by the condition of the soil, and will use the implement likely to achieve the result in the cheapest way, mindful that the object of working in the early stages of fallowing is to conserve the moisture rather than to prepare a seed-bed. No effort should at this time be made to reduce the surface to a fine tilth, for coarse mulches remain effective longer than fine ones.

Before the ground gets very firm, and if free from weeds, the harrow (Fig. 10) can be used cheaply and with advantage. If the ground is set a cultivator should be used, and if weedy the disc cultivator or skim plough.

The one-way disc cultivator (Fig. 11), recently introduced, has proved itself well adapted for economically working fallowed land.

For practical purposes, a mulch of 2½ to 3 inches thick is deemed to be the most economical. Thinner mulches are not effective enough, and thicker ones, though more effective, are not sufficiently more effective to warrant their extra cost.

Fig. 11.—The one-way disc cultivator.

The relative effectiveness of a 1-inch and 3-inch mulch is shown in the following table, taken from "*Physics of the Soil*":—

TABLE showing the relative effectiveness of two mulches, 1 and 3 inches thick.

Character of Mulch.	Moisture content per cent. First foot.	Second foot.	Third foot.	Fouth foot.
1. Cultivated 3 inches deep ...	23·14	23·30	21·94	22·46
2. Cultivated 1 inch deep	22·70	21·08	19·65	19·58
Difference	·44	2·22	2·29	2·88

These differences at the end of the growing season represent 167·4 tons, equivalent to 1·47 inches more water per acre in favour of the deeper mulch.

Though a mulch should be reformed as soon as possible after its effectiveness has been destroyed by rain, nothing will be gained by working the soil

before the surface has a crust on it. If worked before this stage is reached, the implement teeth instead of stirring the soil cut through it like a knife, and this assists rather than retards evaporation.

As the result of the working which the land has received whilst being fallowed, its condition at planting time for the reception of seed should be ideal, especially if the final cultivation, just before seed-time, has been with the skim plough or one-way disc cultivator to ensure that any young weed growth likely to interfere with the welfare of the wheat has been effectually destroyed. As the result of such treatment the seed-bed will be clean, in good tilth, with the soil immediately below the surface in that compact condition which induces vigorous capillarity and admits of the free upward flow of the soil-water from the subsoil, thus providing conditions favourable for ready germination and vigorous growth.

Deep reploughing just before seeding is not recommended; it is likely to prove injurious by making the seed-bed too open and dry for the requirements of the wheat plant, and also by bringing deep lying and dormant weed seeds to the surface where they will have the same opportunities as the wheat to grow and compete with it for existence.

Under a system which provides for the working of fallowed land, the use of the roller to break clods or compact the soil will be unnecessary. During the period of fallowing, any clods that may have originally been present after ploughing will have become weathered down into good tilth.

Nor will there be any need for the use of a special implement like the sub-surface packer to compact the sub-surface soil and so bring the sub-moisture to just below the mulch, where it will be available for the germination of seeds. This will have been accomplished incidentally, as the result of working the fallowed land, the sub-surface soil of which will have become compact as the result of natural settlement, aided by the tramping of the grazing stock, and by the teams and implements passing over the land. During the period between early ploughing and seed time the soil is more thoroughly compacted by the forces of nature than could possibly be done by any implement devised by man.

Growing and consuming Fodder Crops on the Farm.

Of the methods at present in use amongst wheat-growers this has received the least attention, though it is the most important when the permanence and stability of agriculture is taken into account. The best response from fallowing is only obtained when the soil is new or rich in organic matter, and the very operation of fallowing, which is so profitable, tends to burn up this organic matter and, in consequence, each year of fallowing leaves the soil in worse condition to respond to the effect of similar work. By growing fodder crops and consuming them on the farm poor soils can be improved and rich soils maintained so as to be always "new" or rich in fertility. Growing fodder crops is, therefore, necessary and supplementary to fallowing and should go hand in hand with it.

The benefits derived from such a practice, though apparently less direct than those derived from fallowing, are, none the less, as real.

Similar results will be achieved if the wheat paddocks be periodically utilised for grazing. Such a method is only applicable to large holdings, and the results obtained, though good, are not as good as when fodder crops are grown regularly and systematically with wheat, *i.e.*, in rotation with wheat and with each other.

It may be thought by some that unless the green crops are ploughed in instead of being consumed the soil will not benefit very much. That is not so. It is recognised that from 50 to 95 per cent. of the fertilising ingredients in a food are returned in the form of excreta. The crop having passed through the animal's body is in the best condition to encourage the growth of those bacteria known to be so beneficial, whereas a green crop ploughed under produces a condition unfavourable for their activity.

As the feeding value of any crop is invariably greater that its manurial value, it follows that it is not a sound business

Fig. 12.—Ploughing in a green crop—a wasteful practice.

practice to plough a crop in, as in Fig. 12, when stock are available to utilise it and turn it into wool, mutton, beef, or milk.

The question of rotation has been neglected in this new country as it has in other new countries. The reason is that to new settlers in a new country with the fertility of centuries to draw upon, the exhaustion of the soil does not appear possible, and in most cases they are at first more concerned about getting some immediate returns with the least possible amount of labour, rather than larger or more profitable ones with the adoption of better methods which may entail a little more labour or delay. Mainly for those reasons this question has not received the attention here that it has in older countries; it has, however, received some attention during the past few years, and it will receive more attention as its principles and advantages become better understood. Unless attended to it will later demand attention, as the soil having lost its virgin fertility fails to respond even to good methods of tillage or, as it becomes necessary owing to increased land values, to get better and more certain returns, in order to make cultivation profitable, and as the necessity for opening up our drier areas becomes more pressing.

Some farmers baulk at the mention of "rotation of crops," because they misunderstand the term and associate it with a theory derived from a very desirable and profitable practice in older countries, but not applicable to the peculiar conditions of this country. This is a misapprehension. The term simply refers to the order in which crops are made to follow each other in different years on the farm. The man who grows wheat for two or three years and then utilises the land for grazing is practising a rotation though he may not be aware of it.

Wheat is not the only crop which is benefited by being grown in rotation with other crops. It is, with perhaps the possible exception of maize, better suited than other crops to be grown continuously on the same land. If potatoes are made to follow potatoes year after year, the ground becomes so infected with disease that eventually only scabby potatoes can be grown. If rape follows rape the second and succeeding crops fail to make the same satisfactory growth the previous ones made. If cowpeas be made to follow cowpeas they become attacked with eel-worms and disease, and the crop fails. Apart from the wasteful effect upon the fertility of the soil of growing wheat successively, the practice is a bad one, for when wheat is made to follow wheat the land soon becomes foul with weeds, and diseases like take-all make their appearance.

It is, therefore, desirable that wheat, in common with other farm crops, be grown in a rotation with other crops.

Advantages connected with the adoption of a rotation are:—

1. The whole food supply of the soil can be utilised. This is not possible when only one crop is grown, for some crops feed only in the surface soil, leaving stores of food deeper in the soil untouched.
2. The amount of valuable organic matter in the soil can be maintained and even increased.
3. The free nitrogen of the air can be made use of.
4. Insect, fungus, and weed pests can be destroyed or controlled.
5. Provision can be made for the economical distribution of labour throughout the year.

The rotation suitable for the wheat farmer is one in which wheat is grown alternately with a fodder crop. This implies wheat-growing combined with stock-raising.

On small holdings, in most districts of 20 inches and over, this may be so arranged that a crop is grown each year. Such a plan, however, has the disadvantage of entailing that some of the land be prepared in great haste, and possibly at an unsuitable time, and that success with at least one crop is dependent on an opportune fall of rain just prior to planting.

A better plan, and one suitable for most districts, is that of arranging the rotation so that the two crops are grown in three years. This permits of the stubble being utilised for stock feed, and affords ample time for the preparation of the seed-bed, and of the necessary provision being made that the autumn sown crops be preceded by a summer fallow.

Such rotation as suggested is as follows :—

First year—Wheat.

Second year—Stubble.

Third year—Forage crops which will include say, rape, a winter grazing crop ; cowpea, a leguminous crop, and a summer grazing crop ; and sorghum, a summer silage crop.

Attention is called to the word "suggested," for no one rotation can be given which will serve for all wheat farms even in the same district.

Whilst the general principles underlying the rotation are the same, each farmer must plan out the rotation best adapted to suit his soil, and his own particular market or stock requirements.

Some of the general principles that should guide the farmer in planning the order in which the different fodder crops are to be grown are :—

1. That legumes be alternated with non-legumes.
2. That deep-rooting crops be grown regularly when possible.
3. That a definite area of some crop suitable for conserving as silage as a standby in time of scarcity be grown regularly.
4. That the details of the rotation be arranged so that all autumn-sown crops are preceded by a summer fallow.

On a farm with the suggested rotation in operation, the cultivation area would be divided into three portions of approximately equal area, as shown in table below. These portions would be cropped in the same way, though not at the same time. In the same year one portion will be under wheat, a second will be fallowed, and the third devoted to the growth of crops other than wheat—preferably to the growth of fodder crops.

The method of cropping for a farm practising the rotation suggested is as the following table :—

Year.	Paddock No. 1.	Paddock No. 2.	Paddock No. 3.
1908	Fallow Wheat	Stubble Fallow	Rape Cowpea Sorghum
1909	Stubble Fallow	Rape Cowpea Sorghum	Fallow Wheat ....
1910	Rape Cowpea Sorghum	Fallow Wheat	Stubble Fallow ....
1911	Fallow Wheat	Stubble Fallow	Cowpea Sorghum Rape

In the rotation outlined it is assumed that the area devoted to fodder crops would not provide more than sufficient fodder for the stock kept on the farm; but if the area proved too large for this purpose, portion could be devoted to the growth of other profitable money crops, as oats or barley, if these were suitable to the district. The growing of these latter crops, whilst not being as beneficial to the soil as fodder crops, would be a distinct improvement upon the plan of growing wheat continuously, inasmuch as it would help to check the spread of plant diseases.

The results obtained at the Coolabah Experiment Farm during the last four years show that there need be no hesitancy about including forage crops in the rotation.

Fig. 13.—A crop of mustard, Coolabah Experiment Farm, June, 1908.

Figs. 13, 14, and 15 are illustrations of fodder crops grown last year.

The photographs from which the illustrations were made were taken in June, and represent the growth with a rainfall of 2 inches from the time they were planted. In the following September their growth was luxuriant, as the result of another 3 to 4 inches of rain. With suitable methods, these crops will germinate in a dry time, live through a drought waiting for the rain, which eventually does come.

Fig. 14.—Young crop of rape Coolabah Experiment Farm, June, 1908.

Fig. 15.—Young crop of field peas, Coolabah Experiment Farm, June, 1908.

Fig. 16.—Rape at Coolabah Experiment Farm, 1906.

Fig. 16 is an illustration of the main crop of rape in 1906. Fig. 17 is an illustration of the main crop of cowpeas in February, 1909.

It is interesting and instructive to record that there has been no failure with forage crops at the Coolabah Farm since 1905.

Fig. 17.—Cowpeas at Coolabah Experiment Farm, February, 1909.

The method of working which will enable the land to produce the most wheat, is the one which will put the ground in the most suitable and best condition for the production of fodder crops. It is admitted there have been many failures in the past, but it is believed these have been mainly due to defective methods, resulting generally in insufficient preparation of the seed-bed. To sow such crops as rape, tares, peas, &c., in a dry district without preparing the ground thoroughly, and some time beforehand, is to court failure.

Fig. 18.—Canada field peas, Cowra Experiment Farm, August, 1909.

Fig. 19.—Rape at Cowra Experiment Farm, August, 1909—5 months after planting.

The forage crops enumerated are by no means the only ones which can be grown in the rotation, but they will serve as types of the different kinds it is advisable to grow.

Rape is a deep-rooting crop, and provides winter grazing for ewes and lambs, enabling the latter to be quickly topped off as freezers.

Cowpea is a deep-rooting summer legume and is unsurpassed as a soil renovator. With proper treatment it stands drought well, and is excellent for providing succulent grazing from February to June.

Fig. 20.—Rape at Cowra Experiment Farm, August, 1909—4 months after being completely eaten down.

Both rape and cowpea are splendid preparatory crops for cereals; these crops are deep-rooters and utilise plant food in the subsoil, leaving it, as their residues decay, in the surface soil, where it is available for shallower rooted plants. The cowpea in addition is enabled to utilise the free nitrogen of the air, and thus make it available for the plants which are not so fitted by nature to do this.

It is an unsound business principle not to grow a leguminous crop in rotation with wheat or non-leguminous crops, for as the organic matter in the soil becomes destroyed as the result of tillage, exhaustion of the soil nitrogen takes place. As the result of experiments conducted at the Minnesota Experiment Station over a period of eight years, it was found that continuous wheat-growing was very destructive of organic matter and wasteful of nitrogen. In that period it was found that the soil lost 1,700 lb. of nitrogen, 300 lb. only of which were used by the crops produced, and 1,400 lb.

were wasted. Though this waste is enormous it was even greater under a system when wheat was grown alternately with a summer fallow. Under a system in which wheat was grown in rotation with other crops, including legumes, the loss was entirely prevented.

An illustration of the value of including cowpeas in rotation is afforded by the results obtained with oats, at the Alabama Experiment Station. After cowpeas the yield of oats was $31\frac{1}{2}$ bushels, whilst in the same season the yield after a non-leguminous crop like millet, was only 8 bushels per acre.

Sorghum is a drought-resisting heavy-yielding plant, admirably suited for being made into silage.

Whatever may have been the case in the past, no apology is now needed for introducing a silage crop into the rotation, for fodder conservation is now recognised as being of next importance to water conservation.

Fig. 21.—There is no better food for breeding stock than silage, for which purpose sorghum is very suitable.

No better way of conserving fodder can be found than in the form of silage, and a business-like way of doing so is to regularly cultivate a definite area for the purpose, and thus systematically accumulate a store that will prove of great value when the inevitable year of scarcity arrives. Even if a year of scarcity need never be feared, no farm with breeding stock should be without its silage. Even in years when feed is plentiful, the losses at lambing-time are sometimes considerable, because the feed though plentiful is dry. Such losses would be entirely prevented if a ration of silage had been available to counteract the effect of the natural dry feed.

(To be continued.)

On Certain Fungoid Diseases of Potatoes

(Including Irish Blight).

Dr. FRANK TIDSWELL and Mr. T. HARVEY JOHNSTON.
From the Government Bureau of Microbiology.

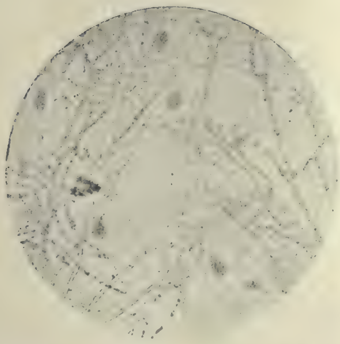
Introduction.

The microbiological examination of very many potatoes during the last six months has revealed to us the prevalence of several fungoid diseases amongst them. In the following pages we have endeavoured to give such an account as will enable growers to become aware of them, recognise them, and safeguard their crops against them. To this end we have prepared statements setting forth the habits of the fungi, the consequences of these habits upon the attacked plants, and the advantage which may be taken of such habits to destroy the fungi. Our point of view is necessarily that of microbiologists, but we urge that this is the aspect essential to successful preventive measures. A knowledge of the life histories of the parasites is the best, in fact the only effective, equipment for circumventing them. We have endeavoured to present the facts with the lessons they teach as briefly as appeared to us consistent with lucidity.

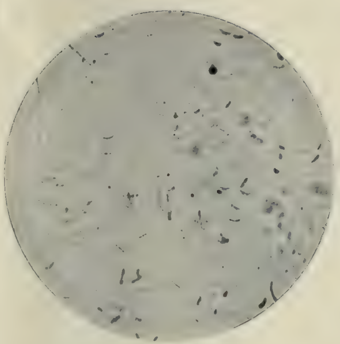
General Characters of Fungi.

Although fungi are members of the vegetable kingdom, they differ from other plants in that they lack green colouring matter, and, consequent upon this, are obliged to get the carbon necessary to their growth from organic materials, instead of from the carbonic acid gas of the air, as green plants do. Hence some are found growing on dung or dead logs, whilst others live on or in living plants or animals. Those which grow on dead matter are called saprophytes; those which grow in living things are generally parasites. But the distinction between the two classes is not sharply defined; there are fungi which can exist upon either dead or living material. In this place we are concerned only with the parasites, these being the active agents of various pests, smuts, blights, rots, and rusts which prejudicially affect the vegetable world.

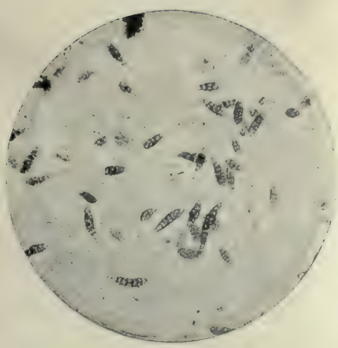
Fungi are familiar to us all as mushrooms, toadstools, moulds, and mildews; and we know of them as being of all sorts, sizes, and colours. But those to which attention is given here are of minute dimensions, and can only be satisfactorily observed with the microscope. Whatever their size may be, fungi, with few exceptions, are made up of threads or filaments (hyphæ), which may be interwoven and massed together in various ways in the larger forms, but in the microscopic fungi are usually single threads, which, at most,



Phytophthora infestans, the fungus of Irish Blight, showing hyphæ and spores (see page 1004).



Fusarium solani, the fungus of Dry Rot, showing spores (see page 1008).



Alternaria solani, the fungus of Leaf Spot, showing hyphæ and spores (see page 1007).

Photo-micrographs of the fungi of Irish Blight, Leaf Spot, and Dry Rot (equally magnified).

Potato haulm affected with Irish Blight. The inset A shows the two halves of a small tuber affected at an early stage.

lie in a loose tangle. The filaments are essentially of two kinds—those which secure nourishment for the fungus (vegetative hyphæ), and those which bear the fruit (fructiferous hyphæ).

The vegetative hyphæ (corresponding to the roots of the higher plants) are buried in the material on which the fungus is growing, and through which they penetrate in all directions, more or less widely, according to circumstances. In the living plant they occupy the spaces between the cells, and sometimes the cells themselves; this last commonly by pushing into them short knobby branches (haustoria). The hyphæ suck up nutritive juices. In the case of the parasites, they take the nourishment intended for the plant in which they grow, or the actual plant substance; the host-plant suffering in consequence. It is likely also that some parasitic fungi injure their host mechanically by their mere presence ("crowding" them so to speak) or by emitting injurious secretions. The effect of any particular fungus upon its host will depend upon these various circumstances, and upon its abundance and vigour in relation to the plant attacked. This latter will suffer more or less, according as it is weak or strong constitutionally or by reason of the method of cultivation adopted; many modern plants are less robust than their wild prototypes, and crops can be predisposed to disease by improper management For a variable time fungi produce only vegetative hyphæ, which spread about and, as it were, get a firm hold; then, perhaps more or less suddenly, the fruit hyphæ are developed. For instance, what is generally known as a mushroom is a mass of fruit-hyphæ and fruit of a fungus which has been previously growing underground; this comparatively large mass of fruit-bearing organs being produced in a single night. In the same way, the parasitic fungi may be quiescent, or gently growing, for some time, and then produce numbers of fruit hyphæ with extraordinary rapidity. Upon these hyphæ there are formed the fruit—spore-bearers and spores—the exact number and character of which vary with different fungi, and afford a means by which the different species can be recognised. Generally speaking, two kinds of spores are formed, according to the season of the year. At the time when the host-plant is in leaf, spore-bearing hyphæ are projected out (from the leaf as a rule) into the air so as to give the spores a chance of being dispersed by the wind, or rain, or birds, or insects, or passing animals. These spores, which are asexually produced (conidio-spores or conidia), are designed to extend the infected area; to secure the geographical dispersal of the fungus. Later on, when the host-plant begins to die or is actually dead, male and female elements are formed by the fungus and combine to produce a sexual spore (oospore) which may remain within the plant even when dead, and in the latter event reaches the soil when the dead plant rots. Such spores are carried about with any plant parts or débris in which they exist. Their essential character is a durability which enables them to survive in a dormant condition from season to season; and even for several years. The design of such spores is to preserve the dispersal of fungus in time; to tide it over periods when it cannot grow. In certain cases where fungi have a more complex life history, there are other modes of spore-formation, designed,

however, to the same ends—the extension of the life of the fungus from plant to plant or from time to time. The consideration of these may be left till another occasion; the modes of spore formation, already mentioned, suffice for appreciation of the behaviour of the fungi described in this paper.

The influences determining spore formation are not finally determined. Certain kinds of spores (for example the conidia mentioned above) appear to be formed under the influence of weather—particular climatic conditions, such as a warm moist atmosphere—causing them to be formed and thrown off in myriads. This is no doubt a provision of Nature to secure propagation of the plant; the weather mentioned being exactly that most favourable to germination of the spores on new plants. Other kinds of spores (for example the oospores mentioned above) are formed under the stress of adverse circumstances. The plant being about to die and the nourishment beginning to fail, the fungus preserves itself till better times come again by producing durable spores. But the formation of the first kind of spore is often coincident with the death of the host—wholly or in part—perhaps the excessive energy exhibited by the fungus on spore formation drains the host plant to exhaustion. The rapidity of the process may contribute to the effect.

It is to be noted that most often the spores or spore-bearing parts of the fungus are the only ones visible to us. When they appear suddenly, as they are apt to do, it may seem to us that then the plant is first attacked, whereas the invisible vegetative hyphæ have been some time in existence. The realisation that spore formation is the act of a fungus which has reached maturity, or even the end of its life, is important as regards remedial measures. The attacked plant is, probably, beyond cure, and generally should be destroyed for the benfit of the other plants of the crop.

The measures necessary to protect plants against fungi must be adapted to the particular fungus concerned, applied so as to meet it at the particular period of its growth when it can be most satisfactorily reached and destroyed. The necessary details in this respect are given in connection with each fungus. In this place, however, it is convenient to mention certain principles concerning the application of fungicides which are of general application, and need to be observed in all cases. Summed up, these principles amount to starting clean and keeping clean by careful attention to the soil, the seed, and the growing plants. It is manifest folly to again plant in land which has recently been occupied by an infected crop, but there is a natural desire to make use of the land again as soon as possible, and so avoid loss of the labour expended in its preparation. Now there is no method by which the land can be certainly disinfected. Disinfecting, liming, &c., are likely to fail; the only hopeful measure in this direction being free exposure to sunlight, the soil being turned over at intervals so that all parts get their share. The sunlight will kill the microbes if it can get at them; but inside little clumps, or even between grains of sand, these tiny beings find places in which to safely hide. In any case spores are resistant sometimes even to sunlight. Hence the cleansing of infected soil is usually to be left to time; crops upon

which it can live being withheld until the parasite has died out. The period necessary varies in each case and is noted below. In the interim the land can be utilised for crops not subject to attack by the fungus in question: this being, of course, one of the objects which rotation is designed to secure.

It being clear then that potatoes must be planted in clean land, surety must be had that the potatoes themselves are clean. A source beyond suspicion is not always possible, and when there is any doubt the safe course is to wash the seed potatoes in disinfectants. In doing this, it is necessary to see that the disinfectant actually gets at all parts of the surface of the tuber. Wash the tubers clean in one lot of disinfectant, and soak them for disinfection in a second lot. The first washing will kill any spores or parts of fungi which may exist in the soil, or dust which clings to the tubers, and which would not be destroyed if these were merely washed clean in water. Indeed, the water running away, or cast away afterwards, might contain living spores, and, most likely, would serve to spread the fungus. Hands which have handled the dirty potatoes must be disinfected before touching the cleansed ones: dirty boxes burnt, bags burnt or boiled, and the places where the operations are carried on well wetted or washed with disinfectant whilst the potatoes are soaking. Everything, in fact, which has been in contact with the seed beforehand must be prevented from touching them afterwards unless it has been disinfected. Owing to the nature of fungi success can only be hoped for by scrupulous attention to these points in every detail.

The interests of the growing crop are promoted by proper methods of cultivation: healthy plants are more resistant to infection by fungi than are those not receiving suitable attention. In the face of a spreading disease any victims should be immediately and completely removed and destroyed; they are seldom worth saving, and are always sources of infection from the other plants. The unattacked portions of the crop may be further protected by spraying with a suitable fungicide. It must be remembered that spraying is a preventive and not a cure. It will not restore health to an already diseased plant; the hyphæ of the fungus are inside, and out of reach of the spray. The idea of the process is to keep all healthy plants covered with a layer of fungicide injurious to the spores, so that these are killed by it instead of being able to germinate when deposited by the wind or other agency. The question of frequency of application, therefore, resolves itself into how often it is necessary to spray in order to maintain this covering. This is a point to be determined by observation: when the coating is fading, or is washed off by rain, it must be reapplied. One man will need to spray once or twice, another many times, in order to bring his crop through to a profitable stage.

After the incidence of the disease on a crop every scrap of the remains should be gathered up and destroyed by burning on the spot—even little bits left may harbour the fungus; and thereafter all implements used in the process should be disinfected, and the same careful precautions taken as were mentioned in the case of cleansing the seed. The feeding of infected plants and tubers to stock is not without risk, as some spores can resist the action of the digestive juices and pass uninjured through the animals. Manure so

derived becomes a source of infection for the plants to which it is applied. Such materials should not be given to stock until after they have been boiled.

The following disinfectants and sprays are those generally recommended for the purposes just mentioned. They are all poisonous, and must be handled with care and kept out of the way of children.

1. *Disinfectants for washing implements, &c.*, may also be used also for tubers instead of corrosive sublimate.

Formalin.—Thoroughly mix 8 ounces (about half a pint) of commercial formalin with 15 gallons of water. Soak the uncut tubers in this solution for about two hours, then dry, cut, and plant as usual.

2. *Disinfectant for Tubers—Corrosive sublimate*:—Dissolve 2 to 2½ ounces of corrosive sublimate in about 2 gallons of hot water, and after several hours dilute this with cold water to make about 15 gallons of solution. Place the tubers in this solution for 1½ hours and then spread out to dry before cutting for planting. Use a wooden or earthenware vessel, since iron or other metal vessels become corroded.

3. *Bordeaux mixture for spraying.*—The following directions are reproduced from an article in the *Agricultural Gazette*, by Mr. F. B. Guthrie, Chemist:—

How to Prepare Bordeaux Mixture.

Directions for preparing Bordeaux Mixture.

Formula:—	Copper Sulphate (bluestone)	4 lb.
	Lime	4 lb.

Made up with 40 gallons water.

Copper Solution.

It is immaterial whether hot or cold water be used to dissolve the bluestone. If the mixture is to be made in a hurry, it is best to boil the copper sulphate in water. If there is plenty of time use cold water; but in this case the bluestone must be suspended in a porous bag (bit of muslin or sacking) as near the surface of the water as possible. If the bluestone is thrown into the vessel, and water poured on the top of it, it will not dissolve in a week. When suspended as described, it should dissolve in about twenty-four hours.

The bluestone solution when made must be diluted largely before the lime solution is added to it. This is a very important point. If the copper solution is too strong, the precipitate formed is thick and heavy, and liable to clog the nozzle of the spray-pump. If the copper solution is made by dissolving the bluestone in a small quantity of hot water, it should be diluted to 20 gallons before adding the lime.

Lime.

The lime, which should be freshly burnt, is slacked with a small quantity of water. Slacking on a board is to be recommended rather than in a cask, because if the lime is really freshly burnt there will be considerable heat

evolved, and the barrel may suffer. Place the whole of the lime on a board, and pour over it about 3 or 4 pints of water. The lime, if it is good, should become very hot, crack asunder, give off a quantity of steam, and finally crumble into a fine white powder. This is now emptied into a barrel and water added. It is not an easy matter to make the whole of the lime into a wash. It cannot be done by simply stirring about with a stick. The best way is to use a shallow tub, so that the lime may be pounded up with the water, all the lumps being broken up. Allow to settle, and pour off the milky solution through a strainer if any lumps are present (into the copper sulphate if you like, or into another barrel), and add more water, repeating the pounding until all the lumps have disappeared.

Mixing.

The mixture must be made by pouring the lime-water into the copper solution, and not by adding the copper solution to the lime-water.

The proportions of the Ingredients.

The proportions above given provide ample lime to more than neutralise all the copper sulphate; in fact, there is more than twice the quantity required to convert the copper into the hydrate, provided, firstly, that the lime is pure; secondly, that it is freshly burnt; and thirdly, that the lime is really all made into wash.

With regard to the latter point, instructions are often disregarded, and in many cases not more than a quarter or half the quantity of lime recommended becomes finally combined with the copper.

If, in addition to this, the lime is not pure, and has been burnt some time before being used, it may quite easily happen that, instead of the above quantities of lime being in excess of what is required, they may be altogether insufficient for the purpose, and that the solution may contain free copper sulphate. Assuming that free copper sulphate, even in small quantities, does "burn" the foliage, and that it is undesirable to have any in the mixture on this account, it appears preferable to have no fixed quantity of lime, but simply to have a definite quantity of copper, and to add the lime until the copper is neutralised.

In order to know when the copper sulphate is neutralised, the readiest test is ferrocyanide of potassium; but it is important to remember that at a certain point ferrocyanide ceases to give the characteristic coloration (in such a solution as we are dealing with), although there is still unaltered copper sulphate in solution. In other words, the solution may contain free sulphate of copper, although the ferrocyanide test, applied as directed, does not show it. Therefore it is important to remember that the mixture is not ready for use when ferrocyanide no longer gives a red colour, but that a quantity more lime (even half as much again) must be added.

Instead of ferrocyanide, a rough test to show when sufficient lime has been added consists in placing a clean knife-blade in the mixture for a few minutes. If there is no red stain on the knife-blade, the copper solution is neutralised. When this point is reached, add more lime.

Vessels employed.

For the copper solution, wooden vessels are preferable, though copper vessels may be used. Iron vessels should be avoided. For the lime, use wooden tubs or barrels. Do not leave the mixture in the spray-pump, as it will slowly attack the copper; but when the spray is finished, pour it away and wash the pump and hose well with water.

Purity of Ingredients.

Samples of "bluestone" are often received which contain a quantity of sulphate of iron. The following hints will enable anyone to detect such a compound. Bluestone should be in the form of dark blue crystals (the adulterated mixture referred to is light blue, like sulphate of iron). They dissolve completely in water—readily and completely in hot water or water to which any acid is added.

In order to test its purity still further, add ammonia. A pale-blue precipitate is formed, which dissolves to an intense blue colour. This solution should be perfectly clear, and leave no sediment on standing. If a reddish sediment settles, it is due to the presence of iron.

Lime.

The best freshly burnt stone lime only should be used. To test it, place a few lumps in a small heap and sprinkle with water. The water should be absorbed by the lime, when the latter gradually falls to pieces, becoming very hot in the process, and giving off a quantity of steam. It gradually crumbles to a fine, white powder. If it does not get hot enough to give off steam, it has not been freshly burnt.

In districts which are troubled with insect pests such as aphids, the potato moth, &c., the addition of about 4 ounces of Paris green, which has first been made into a paste and then stirred into the Bordeaux mixture, is very beneficial.

Irish Blight.

This disease is widely prevalent in Europe and America, and has been known to exist in the southern hemisphere since 1904, when it was detected in New Zealand. Its occurrence in Tasmania, and upon the mainland of Australia, near Brisbane, were announced by Mr. Henry Tryon, Vegetable Pathologist to the Queensland Government, in May and June, 1909. It has since been found in all the other States of the Commonwealth, but the extent of its distribution has not yet been ascertained. In addition to the potato the fungus is known to attack the tomato. It is suspected of being capable of becoming parasitic upon other solanaceous plants so that it would be prudent to keep a wary eye upon the tobacco plant, thorn-apple, nightshade, petunia, and their allies.

The disease is due to the growth of a microscopic fungus (*Phyophthora infestans*, De Bary), which may invade all parts of the plant. In infected tubers the fungus exists in the form of fine filaments (hyphæ) which penetrate more or less deeply and extensively according to the degree of infection.

1.

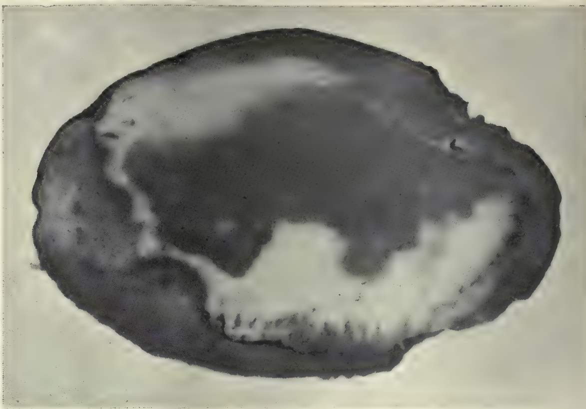
3.

2.

Sections of Potatoes.

1. Normal. 2. Early stage of blight. 3. Later stage of blight.

4.



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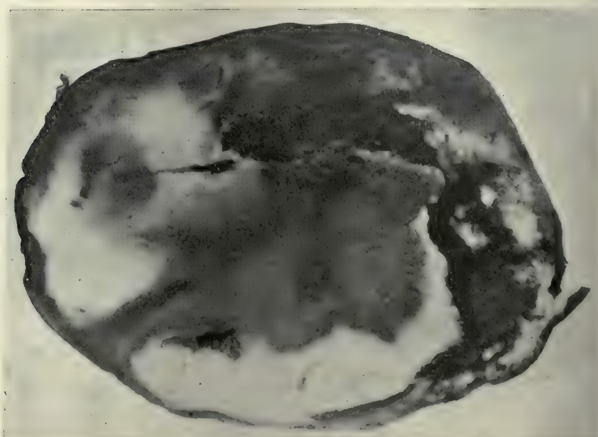


Sections of Potatoes.

4, 5, 6. Successive late stages of blight, showing destruction of tubers.

Whilst the presence of the fungus in the tuber may produce certain changes to be mentioned directly, there may be, on the other hand, no visible indication of its presence. It may remain quite dormant in dug potatoes and only begin to develop when the tuber has again been planted. As the sprouts grow and the stem and leaves are formed the fungus extends its filaments into them, as well as into any new tubers. No part of the plant seems to be immune from invasion. At last filaments are pushed out through openings (stomata) of the leaves and on the filaments so extruded (conidiophores) there are formed spore-bearing organs and spores (conidia) which are easily detached and dispersed by the wind, by ground animals, by passers-by, by implements, perhaps also by birds and insects. Reaching the moist leaves of other plants of the crop the spores germinate there, either directly or after giving rise to mobile bodies called zoospores, and form filaments which penetrate into the leaf, twine about amongst the plant cells, and in time again push spore-bearing filaments through the skin of the leaf. As this process goes on repeating itself the disease acquires a wider and wider spread ; and as the spores are produced in myriads the whole crop may become attacked in a very short time. It is generally held that the tubers become infected by spores which fall from the leaves, or are carried down by the rain to the ground, whence they pass with the soil water to the tubers. The planting of such tubers begins the cycle anew.

It will be gathered from this brief account of the life history of the fungus that there are two phases operating in its spread. By means of the spores formed on the leaves the disease spreads from plant to plant of a single crop or between adjacent or neighbouring crops ; but the dispersal is quite local. On the other hand, by means of the tubers, the disease can be carried over very long distances ; dispersal in this way being potentially world wide. It was thought at one time that the long range infectivity of the tubers depended upon the formation in them of male and female elements which combined to produce a very durable kind of spore (oospore), but the more modern view is that the fungus filaments themselves are endowed with the power of surviving through the period of storage.

Infected tubers may show little or no change. Typically there are dark coloured areas on the surface, more or less sunken and crumpled, easily stripped of peel ; whilst within the potato brownish or sometimes blackish patches or streaks are to be found lying beneath the skin and dipping variously into the flesh. The diseased part of the potato becomes softened and has a peculiar fœtid odour. Such potatoes are very liable to invasion by other fungi and by bacteria, which may cause extensive and foul-smelling rot. From such an obviously diseased condition there are grades all the way to one in which there are no signs visible to the naked eye ; and even when the tuber is not actually infected there may be spores attached to its skin, or in the dust which clings to it. Stored potatoes have been examined in this laboratory which showed on their surface the white mildew to be seen on the leaves of growing plants, and which, as these, was producing spores in abundance.

The first sign of the disease in a growing plant is the appearance of a fine white mould or mildew on the leaves, more especially on the under sides, such mould being actually the spore-bearing filaments being pushed out through the stomata of the leaves. The affected leaves show spots at first brownish then black, which fuse together into areas of dead tissue on, and along the edge of which, the white mildew may be seen advancing upon the remainder of the leaf. The destruction spreads to the stem, the plant wilts and becomes a crumpled black mass in which amongst the remains of the plant there are abundant fungus hyphæ and myriads of spores. It is not a little remarkable that the destructive effect on the plant should be so rapid as to completely destroy it in the course of a day or so. It seems that the fungus filaments may remain in the plant for some time without detriment to it, and then suddenly assume a devastating virulence. This change of character has some correlation to the weather, warm moist days being specially liable to stir the fungus into vigorous activity.

From what has been said it will be gathered that an infected crop is a rather hopeless condition. The plants, the tubers, the rubbish, and the soil are all alike dangerous owing to contamination with spores. Once a plant becomes infected it cannot be cured; it should be forthwith dug up and burnt, together with any others found to be infected, after most painstaking search. The remaining plants should be sprayed with Bordeaux mixture indeed when there is any room for suspicion that blight may appear in the crop spraying should be resorted to as soon as the plants have formed leaves. Special care must be taken to *cover the under sides of the leaves* with the solution, since it is here that the spores usually gain an entrance; but of course the upper side of the leaf should not be neglected. The spraying must be repeated often enough to keep the whole plant covered with fungicide, and protect newly-formed foliage. American experience suggests that three or four sprayings will suffice, but the number must be governed by circumstances; rain for instance might wash off the mixture and necessitate a respraying of the crop. For the reason that the mixture is required to remain on the leaves the spray must be fine, large drops would run off. It is not to be thought that spraying is a safeguard against blight; it is not; all that can be said for it is that when intelligently carried out it will minimise the loss inevitably consequent on the occurrence of the disease. Experience has shown that spraying pays. Tubers might be boiled and then used for feeding, but they are dangerous till boiled. In cleaning up it is safest to gather and burn on the spot everything that can be burned, and to disinfect the implements used in the process, and it must not be forgotten that soil with spores in it may be carried on boots or garments. The infected field should not be planted with potatoes, tomatoes, or other solanaceous plant for some years at least. It must be emphasised that the measures of protection advised need to be thoroughly carried out; the farm will only be safeguarded against the pest by the exercise of detailed and scrupulous care; preservation demands that one must burn, boil, or really disinfect everything that has been in contact with the blight.

Leaf Spot. Early Blight.

The fungus which causes this disease (*Alternaria solani*, or as it is sometimes called *Macrosporium solani*) belongs to a family most members of which are saprophytic in habit. The particular fungus in question seems also to be capable of living as a saprophyte—that is, upon dead organic matter, as well as to be able to attack living potato plants. Apparently as a saprophyte the fungus exists in the soil, perhaps quiescent enough during the winter, but developing with the warmer weather up to the point of producing spores which the wind or other means of transport may carry to potato plants. Here the spores germinate, forming the usual filaments or hyphæ which penetrate the openings (stomata) in the skin (epidermis) of the leaves, and extend within them between and through the tissue cells. In this way the fungus comes to permeate the leaves and stem, but it does not invade the tubers, which are affected by the disease only in a secondary way owing to destruction of the above ground foliage. In course of time the fungus produces spores, which are borne on hyphæ pushed out from the leaf. They continue to be formed on old dead pieces of potato plants in which the fungus may remain actively living owing to its saprophytic capabilities. Being dropped upon the soil, or reaching it with bits of decayed plant, the fungus passes there its winter period of rest, to rouse and form spores again next season as already mentioned. Since the tubers are exempt from attack the fungus is not carried in them: the danger as far as they are concerned is the possibility of spores being transported in the soil or dust which clings to them.

As one of the names signifies, the disease may appear early in the season upon quite young plants, but is apt to become more common and destructive as the season advances. The plants are said to be most liable after the blossoming period, when approaching their natural loss of vigour; quite healthy strong plants possess considerable resistance. When attacked the leaves first show small more or less circular brownish patches which slowly enlarge and join together and cover the greater part of the leaf, the affected tissue becoming brown, withered, and brittle. The surface of these areas is marked with fine wrinkles which form imperfect rings lying one inside the other like markings on a target. The diseased leaves curl up especially at the tips and margins; the unaffected parts lose their healthy green colour and become sickly-looking and yellow. The stems may remain free, and stand defoliated after the destruction of the leaves; but it is said they may be attacked first, the disease working upwards from near the ground. Whichever be the first point of attack the end is usually the death of the whole plant. The tubers show no signs of disease, but will be in such a state of immaturity as they may have reached when the foliage perished, since at that period the food material supplied to them by the leaves is cut off and they cannot further grow. Thus, whilst the disease itself does not attack them, their incomplete development spoils them for market and exposes them to rot from other causes.

The preventive measures consist of the avoidance of infected ground and of seed from infected or suspicious sources ; spraying with Bordeaux mixture when the disease is prevalent. The chances of cleaning the soil demands that it be kept free from potatoes for several years.

The leaves are often injured by weather conditions, and effects known as tip-burn and sunscald are produced which resemble early blight. Dry, hot weather, with lack of water in the soil, will cause tip-burn, which is the death and drying of the leaf margins, and sometimes spots away from the leaf edge, especially where punctures by insects have caused loss of water. Sun scald occurs when after long continued damp weather, several hot and bright days burn the foliage, and is especially liable to occur where soils carry little moisture. In damp weather the plant becomes gorged with water, and so weakened : the sun on the leaves in this condition causes evaporation of the moisture ; if this be quick, and supply from the roots continue deficient for any length of time the more tender parts (the tips and edges) will turn brown and roll up. Injured spots (bitten) away from the edges suffer similarly. The same effect may be caused by application of fungicides—for instance, Paris Green.

Fungi having spores which closely resemble *Altenaria solani* (*Macrosporium* and also *Cladosporium*) are sometimes found on these dead tissues. They are saprophytic only. But also there may be present the parasitic *Macrosporium*, which is quick to establish itself upon the weakened portions of the leaves, or even upon the dead tissues and becoming established there, invades the adjoining green parts.

Dry Rot.

This disease is due to a fungus (commonly known as *Fusarium solani*, Sacc., though the name *Fusarium oxysporum*, Schlect., is the more correct one), which lives in the soil and attacks the lower parts of the plant, entering the roots and then gradually extending its filaments into the tubers and lower part of the stem. Usually it does not grow into the upper parts of the stem or leaves. In the roots there occurs a dry rot, the presence of the fungus being manifested by a whitish or pinkish mould. Under the microscope this is seen to consist of filaments and myriads of tiny septate sickle-shaped spores. These remain in the soil when the plant dies. Since the roots are attacked, the food supply of the plant becomes diminished, and consequently it becomes sickly. The leaves become lighter in colour, growth is impeded, and finally when the roots become so much affected that they cannot support the plant, the parts above ground wilt and generally die.

The slow growth of the parasite generally allows the tubers to become fairly matured, hence the disease in them may remain unnoticed until after storing. If the tubers be cut across, the disease may be detected by the occurrence of a stain in the vascular area forming a brown ring under the skin, which differs from that seen in potato bacteriosis by being free from the milky juice present in the latter. The *Fusarium* invades the potato

Dry Rot (*Fusarium solani vel oxysporum*).

Potato Scab (*Oospora scabies*).

The specimens for these illustrations were picked haphazard from the top of a sack of potatoes.

from the underground stem, and hence one end of it becomes diseased before the other (end rot); but the parasite may also gain direct entrance through wounds, and consequently a tuber may possess many local infections, in which case neither the "brown ring" nor the "end rot" may be obvious. The disease continues to advance during storage, the filaments still growing forwards and eventually destroying the tuber, which shrinks and becomes wrinkled, being finally converted into a very light, hard, brittle mass.

On the surface of infected parts and in the cavities which sometimes occur in potatoes a dense white myselium appears, made up of the filaments, and after a time spores are produced. There are three kinds of spores formed, but usually only the sickle-shaped bodies appear abundantly on the tubers. These may cause the infection of sound potatoes stored along with the diseased ones if there be the slightest wound or puncture, even though quite microscopic, through which they can effect an entrance. Since warmth promotes a more vigorous growth of the *Fusarium*, the store should be kept cool (35 degrees to 40 degrees Fahr.)

Owing to the fact that the fungus lives in the soil and attacks the plant underground and at any time during the life of the potato, the disease is a difficult one to combat. Badly affected areas are best abandoned, as they will infect clean seed put into them. Any seed not above suspicion should be cut across at the stem end and examined for the brown or blackened ring, or signs of rot, the presence of which should lead to rejection of the tuber. From the account given, it will be seen that spraying is not applicable to this disease.

Scab.

A disease of world-wide prevalence, found probably wherever potatoes are grown. The same, or a closely similar disease, attacks the beetroot, turnip, radish, carrot, and cabbage.

The condition is due to the operations of a minute fungus (*Oospora scabies*, Thaxter, or in some places to *Sorosporium scabies*, Fischer), which lives in the soil and in the affected plants. Given access to tubers, the fungus invades the skin, irritates it, and causes the production of corky spots and areas, which later become thickened, rough, and cracked; the other parts of the plant are not materially affected. The fungus is to be seen as a delicate white mould at the edge of the spots on freshly-dug half-grown potatoes, but soon dries up and disappears. The microscopical spores are abundant in the scab spots, and if applied to the surface of young tubers may produce the condition in from three to ten days. The disease is spread by the spores being carried into new soil with the tubers, and once in the soil, the fungus is said to be able to survive for years, even if no further potatoes are planted therein.

From this description it will be seen that scab is an underground disease, the only effect of which is to render the tubers unsightly, and (it is said) more liable to rot during storage. The flavour and cooking qualities are not impaired, but the thickening causes waste in peeling. Badly-scabbed potatoes

may be unfit for table use; and not very valuable for feeding to stock or starch-making.

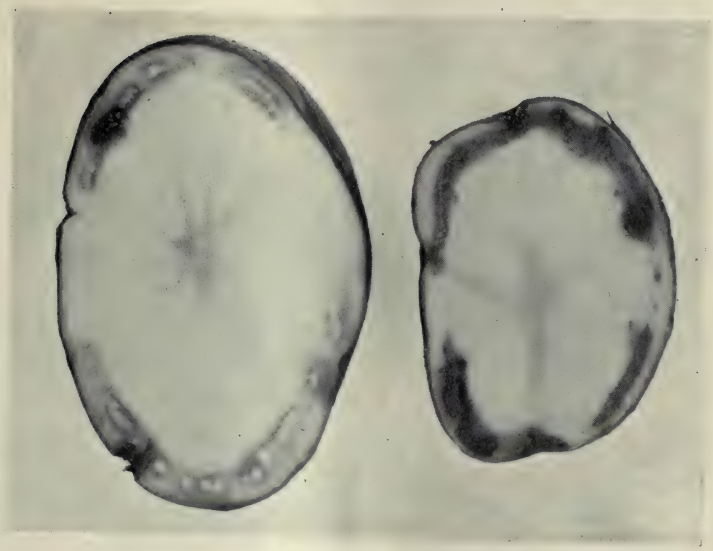
It follows from what has been said that scabby potatoes used as seed will infect the soil into which they are put, and year after year, as the fungus spreads in the soil, the proportion of scabbed tubers will increase. It follows also that planting healthy seed in soil already infected (*i.e.*, from which scabbed potatoes have come) is simply inviting the new stock also to become scabbed. Hence the simple preventive rule is to avoid using scabbed tubers as seed, and to avoid planting healthy seed in scabby ground. In the event of a grower being obliged to use "scabbed" seed, the material may be treated with the fungicides mentioned later. These have a chance of killing this particular fungus, since it lives at the surface of the potato. Scabbed land is very difficult to clean, there being no means known of getting rid of the fungus except to let it die out. This implies that for several years the land must not be planted with any of the crops upon which the fungus could feed. Rotation, if tried, should be a long one as the fungus is reported to have remained in the soil for five or six years.

Bacteriosis.

(*Wet rot, brown rot, or bacterial wilt.*)

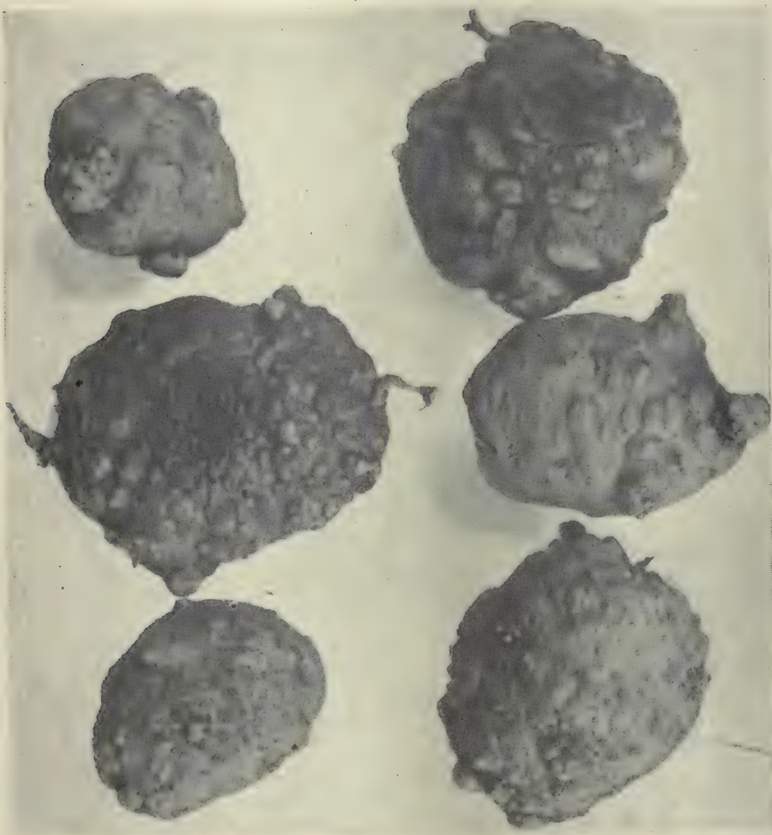
This disease is caused, not by a fungus, but by a closely allied bacterial parasite (*Bacillus solanacearum*, Erwin Smith), which may attack tomatoes, egg-plants, and other solanaceous plants as well as potatoes. The structure of the bacillus is very simple, consisting of very minute rod-like bodies, like short pieces of thread, with the ends rounded off. There are no filaments nor spores. Each of the little rods is a complete individual, which multiplies by merely dividing into two; a process repeated, perhaps, every half hour, and so leading to an extraordinary rapid increase. It is probable that these bacilli are permanently present in certain soils, and that originally, or at times, the soil is the source of infection for the crops. More usually, however, plants become infected by inoculation, the bacilli being introduced by biting insects which have acquired them from diseased plants upon which they have fed. Once introduced, the bacilli are able to live upon the plant juices and protoplasm; they spread from the inoculated spot (say upon a leaf) along the sap channels (vascular bundles) to the stem, down it to the tubers, and to other branches of the plant. Subsequently they spread from the vascular bundles, and invade all the softer parts of the plant. The bacteria possess the power of surviving from season to season in the soil, in tubers, or in diseased portions of the plants.

The affected plants show first browning or blackening at the site or sites of inoculation. As the bacteria spread in them, the leaves gradually lose their bright clear colour, and become pale, yellowish, and muddy, finally black and rotten. The stems turn yellow, shrivel, and wilt; then the whole plant collapses. The tubers show various degrees of change, according to the extent to which the bacteria have invaded them. They may not yet



Bacteriosis (Wet Rot, Brown Rot, or Bacterial Rot).

Brown Fleck.



Potatoes infested with Eel-worms.
(Photograph by C. T. Musson, Hawkesbury Agricultural College.)

have been reached when the plant wilts, and so may be healthy. If only just reached, there may be no visible change, but the tubers may go bad on storage. When rather more affected, there is a brown discolouration of the cut tuber in a ring under the skin (along the vascular bundles). The skin and the heart of the tuber may be unaffected. In advanced stages the tubers are obviously diseased, and show a brown or black rot located at the stem end, or extending therefrom, which may have reached any stage up to complete destruction. Messrs. C. T. Musson and George Marks (*Agricultural Gazette*, N.S.W., 1905, p. 186) note that the disease appears in a plant here and there amongst the crop, the neighbours of which remain apparently quite healthy. No doubt the exact appearance depends on the number of insects concerned in the dispersal of the bacteria. From the infected parts, when cut across, there oozes, or can be squeezed, a slimy, dirty white or yellowish-white juice, which contains the bacteria in myriads.

The removal and destruction of infected plants and rubbish, the avoidance of infected lands and the use of clean seed are the chief precautionary measures. Very thorough and persistent spraying, using Bordeaux mixture with arsenic to prevent the action of the insects, which scatter the bacteria, and to kill the bacteria themselves, is the best treatment, although not perfectly effective. The tubers should be dug early, and if stored they must be kept in a cool, dry place to keep back the rot. In planting avoid land that has recently borne tomatoes, potatoes, or egg plants affected with this disease.

Under moist warm conditions a soft or wet rot due to various bacteria and fungi may develop in potato tubers when stored or even before they are dug. This is entirely a matter of putrefaction of a perishable article and avoidable by proper management.

Gall-worm or Eel-worm.

In addition to parasitic fungi the potato may suffer from parasitic worms, especially the eel-worm or gall-worm (*Tylenchus devastatrix*) which attacks the tubers. Penetration of the tuber is effected by the use of a spear-like piercing organ; and the worm is provided with a bulb for sucking up the plant juices upon which it lives. In these small worms the sexes are distinct, and both males and females live in the soil. But in affected tubers the female alone is found, and she has become degenerated into a mere bag which contains the numerous eggs. These eggs contain living embryos; sometimes the worm bears free living young. The embryos become liberated into the soil through the decay of the plant, grow to maturity, pair, and then enter the plant tissues. Young gall-worms can withstand adverse circumstances such as drying, lack of food, &c., for years. Consequently, the planting of tubers in infected land is an unwise proceeding. The eggs and worms may be carried about by wind, rain, and ordinary soil drainage. The farmer's boots, tools, vehicles, &c., may also be transporting agents.

As the name implies the worm causes "galls," or small wart-like swellings on the surface of the tubers, within each of which is to be found a richly

egg-laden worm. They do not penetrate deeply, and so do not injure the flesh. The condition is probably caused by the mechanical irritation due to the worm's presence stimulating the potato cells to the local overgrowth which forms the gall. Similar galls are produced in a similar manner by various insects, mites, fungi and bacteria.

Infected soil and infected tubers are to be avoided. The cleansing of the land may be attempted by deep-ploughing, which may bury the worms too deep for survival; and the planting only of crops such as maize or barley—which are not much affected by the parasites. This must be continued for several years.

Brown Fleck or Internal Brown Spot.

This is a fairly common condition. Its general appearance, as seen in a cut tuber, is shown in the accompanying figure. There may be only one or two small brown spots, or almost the whole of the tuber may be affected. These discoloured areas consist of dead tissue, and are somewhat firmer than the surrounding normal tissue. No parasite has as yet been associated with the condition. Certain varieties of potatoes seem to be more susceptible, and it has been suggested that the soil has something to do with it. The lack of knowledge as to the cause prevents suggestions as to remedial measures.

Solanaceous Plants in New South Wales.

In view of the fact that the fungus of Irish blight and of some other diseases of potatoes have been known to affect several plants belonging to the Solanaceous family, the following list, furnished by Mr. J. H. Maiden, Director of the Botanic Gardens, Sydney, is of interest:—

Foreign *Solanaceæ* naturalized in New South Wales:—

Datura stramonium, L.	Thorn Apple.
Nicotiana glauca, Grah.	Tree Tobacco.
Nicandra physaloides, Gaertn.	Apple of Peru.
Physalis peruviana, Linn.	Peruvian or Cape Gooseberry.
Hyoscyamus niger, Linn.	Common Henbane.
Petunia nyctaginiflora, Juss.	Common Petunia.
Solanum auriculatum, Ait.	
,, pseudo-capsicum, L.	Jerusalem Cherry.
,, Sodomaeum, L.	
,, aculeatissimum, Jacq.	
,, rostratum, Dun.	

New South Wales *Solanaceæ*. The following species are likely to be found near cultivated fields:—

Physalis minima, Linn.	
Solanum nigrum, Linn.	Garden Night-shade.
,, aviculare, Forst.	
,, vescum, F.v.M.	
,, simile, F.v.M.	
,, verbascifolium, L., and 22 more species.	
Lycium australe, F.v.M.	Murray Box-Thorn.
Nicotiana suaveolens, Lehm.	Australian Tobacco.
Anthocercis, 3 species.	
Duboisia myoporoides, R.Br.	Corkwood, and two more species.

Dural Demonstration Orchard.

W. J. ALLEN.

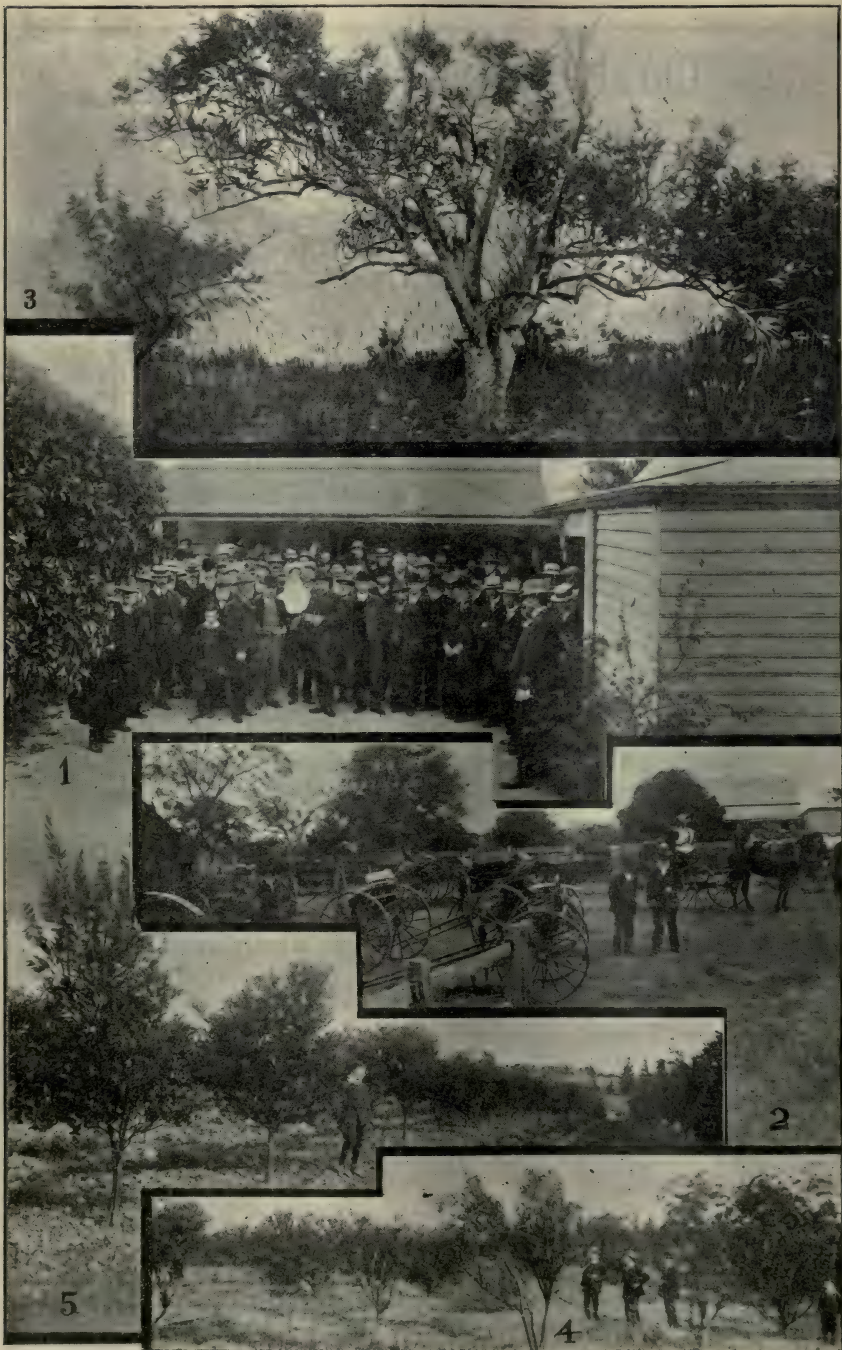
FOR many years the Cumberland fruit-growers have been urging the Department of Agriculture to start an orchard in their midst, and though I am not quite sure that they ever advanced set reasons in support of their request, yet it was claimed by some that it would be a good thing for the Department to have such a place, where experiments might be carried out for fighting the various pests which growers have found it so difficult to keep in check. Others thought that it would be a good opportunity for the Government to test different varieties of fruits in order to ascertain which were the most profitable varieties to grow. The question, too, of renewing land on which fruit-trees had been growing for years cropped up, as well as that of endeavouring to prove whether or not an old and neglected tree could be made to again produce profitable crops.

There were a good many who thought it might be well for the Department to show that fruit-growing could be made to pay, and hoped it would inaugurate a system of book-keeping which would enable them to determine whether or not the orchard was paying interest on the money expended on the purchase of the land and proper plant, as well as for all work in connection with experiments. The majority of growers, however, do not favour an orchard run as a commercial undertaking, but consider that if the Department will devote its energies to the carrying out of systematic experiments, in order to try and solve the many questions which, up to the present, have not been settled to the satisfaction of either the Department or growers themselves, it would be doing the best work, and fruit-growers would derive the greatest benefit thereby.

In starting such an orchard, it is essential to have in charge an officer who has had a wide experience in fruit-growing, not only in the Cumberland county but in other districts and countries. A large part of his time will be spent in showing interested visitors—whether fruit-growers, farmers, or gardeners—the different experiments, and explaining to them how they are being conducted. A portion of his time will, necessarily, be occupied in taking notes, attending to inquiries, and other clerical duties, so that the time which has to be charged to the farm is really mostly taken up in attending to duties which are not directly chargeable to the working of any commercial orchard.

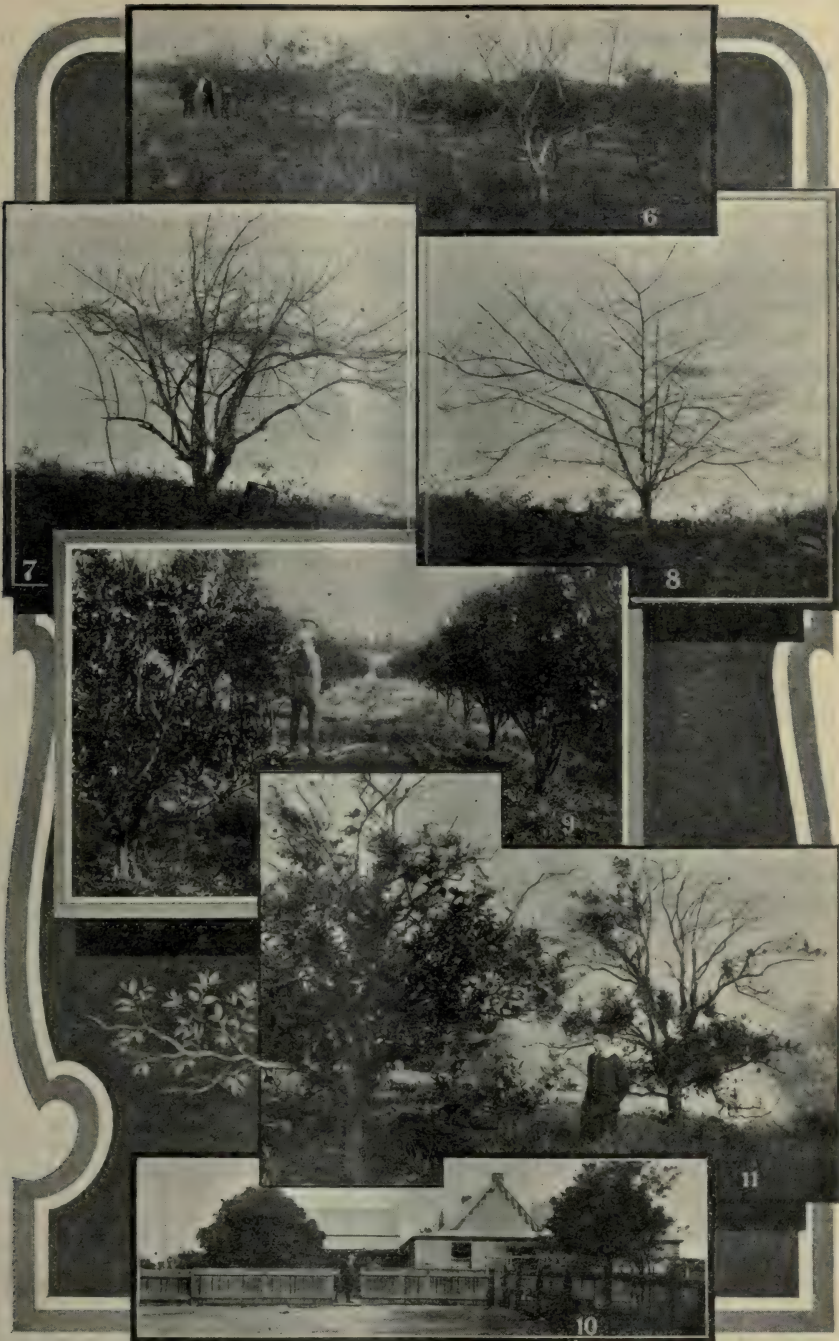
Then, again, to carry out experiments properly they must be conducted in such a way that when they are completed we will be able to give the actual cost of same as well as the results. Growers will then be able to form their own conclusions as to which of the experiments they wish to follow or which to avoid.

It is our intention to carry out some careful experiments in manuring, liming, subsoiling, most suitable stocks for citrus trees, as well as to try and find out which are the most suitable varieties of fruits to grow.



DURAL DEMONSTRATION ORCHARD.

1.—Some of the visitors. 2.—The orchard yard. 3.—A typical specimen of the older orange trees. 4.—Mandarin trees in all stages of neglect. 5.—A row of the best trees in the orchard.



DURAL DEMONSTRATION ORCHARD.

6.—Typical specimens of the lemon-trees. 7.—An apple tree. 8.—A peach tree, showing neglect of pruning. 9.—Rows of trees planted 10 feet x 10 feet apart. 10.—The orchard homestead. 11.—Two orange trees, typical of many others in the orchard, which have passed the age of usefulness and are to be uprooted.

In order to carry the work out at all systematically, we have found it advisable to uproot the greater part of the orchard. We are, however, retaining two small plots of citrus trees, in order that we may experiment in the fighting of the different diseases to which such trees are subject; but I may say I do not anticipate any great trouble in ridding them of any diseases other than the Black Spot and Melanose, and we will do our best to keep these latter two in check. The land was purchased too late in the season to enable us to prepare and plant this year, and, indeed, I am doubtful whether, if it had been ready, we could have secured the varieties of trees worked on the stocks we require this year.

The land will be cleared and subsoiled and well fallowed during the coming summer and made ready to receive the trees next winter. A portion of the land will have to be cleared before it can be planted. We will then have for comparison trees growing on virgin soil side by side with the same varieties planted on land which has had fruit-trees on it for fifty years. This will be a valuable object lesson and will enable us to compare the quantity and quality of fruit taken from the different trees.

On Saturday, the 24th of July, the Department invited the fruit-growers of the State to pay the place a visit in order to see what it looked like before the work of reconstruction was put in hand.

From time to time as the work of reconstruction progresses, illustrated progress reports will be given in order that those growers who cannot visit the place may be kept in touch with the work as it is being carried out. I have already prepared a plan showing where each kind and variety of tree is to be planted, and also showing which portion is to be subsoiled, which limed, and where the different manures are to be applied.

There is to be a road running through the centre of the orchard, at the sides of which will be notice-boards giving all details of the experiments in the different plots—as soon as the planting is complete.

Closer Settlement.

Attention is directed to the notices appearing in this issue in respect to farms available under the Closer Settlement Acts in the Coreen and Back Paddock portions of the Gunambil Estate, Corowa district.

Full particulars may be had on application to the Under Secretary for Lands, Sydney, or local Lands Offices.

Sheep at Bathurst Experiment Farm.

R. W. PEACOCK, Manager.

AT the New South Wales Sheepbreeders' Association Show, held in July, 1909, another practical demonstration of the results of cross-breeding of sheep for lamb and mutton suitable for export was given. This exhibit was more comprehensive than those of previous years. Thirty-two pens were shown, and comprised first, second, and third crosses, as well as a pen of merino ewes of a type recommended as foundation stock.

Of the thirty-one pens representing the crossbreds, a sheep from each was slaughtered, and the carcases exhibited in front of the pens. What could be expected from a mutton point of view was thus apparent, and those interested could, by inspecting the live sheep, form opinions respecting the value of the crosses from a wool-producing standpoint.

Allowance should be made, when considering the tables of live and dressed weights, &c., for the individuality of sheep. Although they were chosen very carefully as typical specimens, slight errors cannot be eliminated when figures are given for individuals only. This especially refers this year to carcass No. 35.

This year's results are in accord with those of previous years.

A standard has been fixed against which to measure other crosses in future, instead of carrying so many at the same time, which becomes burdensome.

In addition to the weights of carcases, skins, and fat being available, a report upon the suitability of the carcases for export has been submitted by Messrs. Birt & Co., and one upon the skins by Messrs. Winchcombe, Carson, & Co., Ltd. These, in conjunction with the average weights of fleeces from weaners exhibited at Show of 1908, a report by Messrs. Goldsbrough, Mort, & Co., Ltd., upon them; the notes for hardiness, taken after a very severe season; notes on the difficulties of Merino ewes at parturition when mated with rams of English breeds; and results of experiments upon removing tails by using the knife *versus* the searing iron, provide much food for reflection and valuable data respecting the question of cross-breeding.

The season was a bad one, and provided an opportunity for testing the crosses for hardiness.

After shearing, the sheep were inspected and selected for condition, and as far as could be judged those having the largest proportion of Southdown blood were in the best condition. Those having Shropshire blood were next, whereas those with Lincoln and English Leicester blood did not retain their condition so well.

Generally speaking, the second crosses were the best, the first crosses next, and the comebacks were the worst. Those containing the greatest amount of English blood were the fattest, especially that of the Southdown, and those with the largest proportion of merino blood were the poorest.

It would appear from such that the ability to put on and retain condition is proportionate with the amount of covering, those with the least wool carried most condition, and those with the most wool carried least condition.

As wool is of such importance in Australia, and carcases the desideratum in England, it taxes the ingenuity of the breeder to combine the two in a practical manner. From the past experiences at this farm, the cross which appears to meet the requirements best as a dual-purpose sheep and one that can be bred without serious disadvantages is a Shropshire-English Leicester-Merino.

For future experiments this cross will be used as the standard against which to measure other crosses.

In the plates a carcass of this standard has been placed in several for comparison, see No. 42.

It is interesting to note the differences between the carcases of the first crosses, those bred from Merino ewes; the second crosses, those bred from crossbred ewes; and of the third crosses, those bred from comeback ewes.

The average dressed weights from six sheep of the first-cross weaners is 40½ lb., from eight of the second-cross weaners is 55 lb., from three of the third-cross weaners is 47 lb.

The second crosses, or those from the crossbred ewes, have the advantage in weight over the first crosses of 14½ lb., and of 8 lb. over those bred from comebacks. Also, the carcases of the first crosses were all classed as ordinary second and third-class quality, whereas those from crossbred ewes were classed from good to prime quality; so also were those from comebacks.

The advantage from using crossbred or comeback ewes as breeders over the Merino ewes is very apparent.

The question of breeding crossbred mothers and comebacks is an important one. Large-framed, plain-bodied ewes, such as those exhibited, are the best type for the foundation Merino stock. The English breed which is favoured under conditions at this farm to mate with Merino ewes is the English Leicester.

It will be seen from the following reports that such a cross involves the minimum of loss at parturition, the carcass is of the correct shape, colour, and quality, and the wool is of good, useful quality—an important point in a breeding ewe.

These crossbreds, when mated again with Merino rams to produce comebacks, are very satisfactory, as such produce wool of excellent quality and quantity.

There is not the slightest doubt that the improvement of Australian wool in the future will be on the lines of quality rather than of quantity upon an individual, and such cannot be neglected when breeding ewes suitable for the production of prime lambs for export.

The following are the particulars of live weights, dressed weights, skins, and fat of the sheep slaughtered:—

Identification No.	Breed.	Live Weight.	Dressed Weight.	Skin.	Fat.
	Hoggets, age 23 *months.*	lb.	lb.	lb.	lb.
22	Shropshire-Merino	123	67	18	9
23	Southdown-Merino	110	59	19	9½
24	English Leicester-Merino	118	66	18	8¼
25	Lincoln-Merino	123	67	21	13
26	Shropshire ram on Shropshire-Merino ewe	144	83	17	12
27	Shropshire ram on Lincoln-Merino ewe	123	67	21	7¼
28	Lincoln ram on Shropshire-Merino ewe	146	86	21	10
29	Southdown ram on Lincoln-Merino ewe	120	73	15	10¼
30	Southdown ram on Southdown-Merino ewe	119	68	15	9¼
31	Shropshire ram on Comeback ewe (Lincoln)	132	75	18	12
32	Lincoln ram on Comeback ewe (English Leicester)...	122	69	20	9¼
33	Merino ram on English Leicester-Merino ewe ...	122	66	22	8
34	Merino ram on Border Leicester-Merino ewe ...	119	60	24	8¾
	NOTE.—The hogget skins had 10½ months' growth of wool.				
	Weaners, 11 *months.*				
35	Shropshire-Merino	75	36	14	3½
36	Southdown-Merino	79	41	14	5
37	English Leicester-Merino	81	40	18	4
38	Lincoln-Merino	88	43	18	4¼
39	Romney Marsh-Merino	81	40	15	6
40	Dorset Horn-Merino	85	43	14	6
41	Shropshire ram on Border Leicester-Merino ewe.. ...	113	59	20	5¼
42	Shropshire ram on English Leicester-Merino ewe ...	101	53	19	7¼
43	Shropshire ram on Lincoln-Merino ewe	100	53	20	5¾
44	Shropshire ram on Shropshire-Merino ewe	99	52	16	6
45	Lincoln ram on Shropshire-Merino ewe	103	56	16	7¼
46	English Leicester ram on Southdown-Merino ewe ...	94	52	15	8
47	Southdown ram on Lincoln-Merino ewe	103	56	18	6½
48	Southdown ram on Border Leicester-Merino ewe ...	106	59	16	7¾
49	Southdown ram on English Leicester-Merino ewe ...	92	52	14	7
50	Shropshire ram on Comeback ewe (Lincoln)... ...	93	51	15	5¼
51	Shropshire ram on Comeback ewe (Border Leicester)	87	46	15	6½
52	Shropshire ram on Comeback ewe (English Leicester)	84	44	14	5¾
	Weaners were unshorn, and carried 11 months' wool.				

The weaners were the progeny of young ewes, they being their first lamb. Dry weather was also experienced at weaning. Under such conditions, the best results are not obtainable.

The following is the report of Messrs. Birt & Co., upon the carcases, coupled with the report of Messrs. Winchcombe, Carson, & Co., Ltd., upon the skins.

Ages—23 months. **No. 22.**

Shropshire-Merino—123 lb., 67 lb., 18 lb., 9 lb.

The Carcass.—Good shape, prime quality, bright colour; very suitable for export; dressed weight less 6 per cent., and kidney fat to be removed.

The Skin.—Pelt, good; wool, nice, fine crossbred, short and dense.

No. 23.

Southdown-Merino—110 lb., 59 lb., 19 lb., 9½ lb.

The Carcass.—Correct shape, prime quality; suitable for export.

The Skin.—Pelt, good; wool, very good length; a very useful type of wool.

No. 24.

English Leicester-Merino—118 lb., 66 lb., 18 lb., 8¼ lb.

The Carcass.—Prime quality ; shape, colour, &c., good ; very suitable ; only fault, "leggy."

The Skin.—Pelt, moderate ; wool, good length ; strong, useful wool.

No. 25.

Lincoln-Merino—123 lb., 67 lb., 21 lb., 13 lb.

The Carcass.—Good quality, irregular shape, rather gross, though suitable general trade mutton.

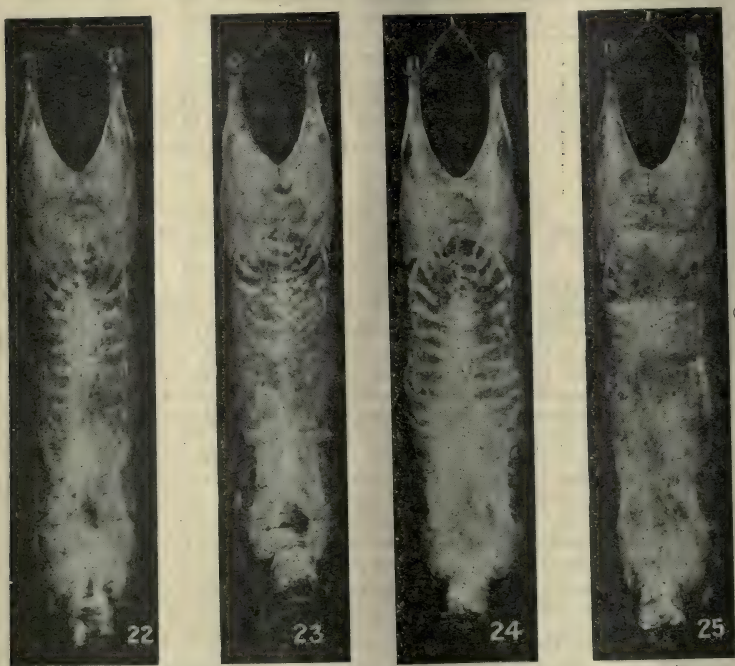
The Skin.—Pelt, very good ; wool, nice character, fine crossbred, on the short side.

No. 26.

Shropshire-Shropshire-Merino—144 lb., 83 lb., 17 lb., 12 lb.

The Carcass.—Prime quality ; shape, colour, &c., correct ; too heavy for export.

The Skin.—Pelt, fair ; wool, nice type of very fair crossbred ; moderate length.



First Cross—age 23 months.

22. Shropshire x Merino. 23. Southdown x Merino. 24. English Leicester x Merino. 25. Lincoln x Merino.

No. 27.

Shropshire-Lincoln-Merino—123 lb., 67 lb., 21 lb., 7¼ lb.

The Carcass.—Prime quality, irregular shape, &c., but suitable for export.

The Skin.—Pelt, good ; wool, fuzzy ; undesirable wool.

No. 28.

Lincoln-Shropshire-Merino—146 lb., 86 lb., 21 lb., 10 lb.

The Carcass.—Prime quality, good shape, colour, &c. ; only fault, too heavy.

The Skin.—Pelt, very large ; wool, fuzzy ; no character ; good length.

No. 29.

Southdown-Lincoln-Merino—120 lb., 73 lb., 15 lb., 10¼ lb.

The Carcass.—Prime quality, perfect shape, colour, &c. ; only fault, too heavy.

The Skin.—Pelt, fair ; wool, fuzzy ; no character ; lacks length.

No. 30.

Southdown-Southdown-Merino—119 lb., 68 lb., 15 lb., 9¼ lb.

The Carcass.—Prime quality, perfect shape; colour, &c., very suitable; rather heavy, but very fleshy.

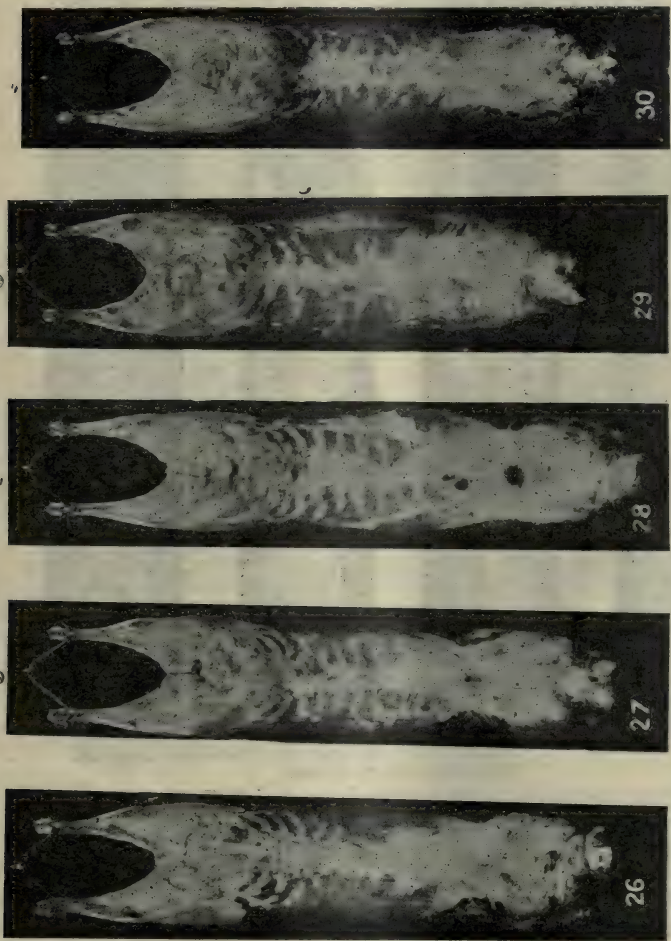
The Skin.—Pelt, small; wool, fair length and quality, wasty tip.

No. 31.

Shropshire-Comeback-Lincoln ewe—132 lb., 75 lb., 18 lb., 12 lb.

The Carcass.—Prime quality, good shape, colour, &c.; very fleshy; only fault, weighty.

The Skin.—Pelt, good; wool, poor, wasty.



Second Cross—age 28 months.

26. Shropshire x Shropshire-Merino ewe. 27 Shropshire x Lincoln-Merino ewe. 28. Lincoln x Shropshire-Merino ew . 29. Southdown x Lincoln-Merino ewe. 30. Southdown x Southdown-Merino ewe.

No. 32.

Lincoln-Comeback (English Leicester)—122 lb., 69 lb., 20 lb., 9¼ lb.

The Carcass.—Prime quality, good shape, colour, &c.; rather heavy.

The Skin.—Pelt, good, big; wool, good length, wasty tip.

No. 33.

Merino-English Leicester-Merino—122 lb., 66 lb., 22 lb., 8 lb.

The Carcass.—Prime quality, good colour; faulty in legs, not covered; too much merino leg.

The Skin.—Pelt, good; wool, the best of the lot.

No. 34.

Merino Border-Leicester-Merino--119 lb., 60 lb., 24 lb., 8¾ lb.
The Carcass.—Second quality, ordinary merino type predominating.
The Skin.—Pelt, good, large; wool, dense, fine, fair length, useful wool.

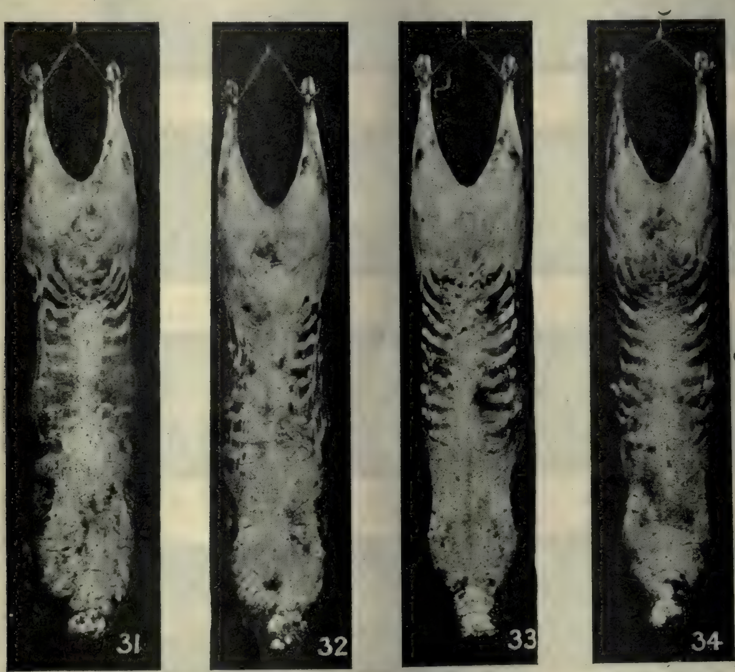
Ages, 11 *months.*

No. 35.

Shropshire-Merino—75 lb., 36 lb., 14 lb., 3½ lb.
The Carcass.—Ordinary third-class quality, wanting in every degree.
The Skin.—Pelt, small; wool, moderate to short; small skin, fine quality.

No. 36.

Southdown-Merino—79 lb., 41 lb., 14 lb., 5 lb.
The Carcass.—Ordinary second-class quality; shape and colour good.
The Skin.—Pelt, small; wool, short and undesirable.



Third Cross—age 23 months.

31. Shropshire x Comeback ewe (English Leicester). 32. Lincoln x Comeback ewe (English Leicester). 33. Comeback-Merino x English Leicester-Merino ewe. 34. Comeback-Merino x Border Leicester-Merino ewe.

No. 37.

English Leicester-Merino—81 lb., 40 lb., 18 lb., 4 lb.
The Carcass.—Ordinary second-class quality; shape and colour good.
The Skin.—Pelt, good; wool, very useful type, strong, desirable, crossbred, dense.

No. 38.

Lincoln-Merino—88 lb., 43 lb., 18 lb., 4¼ lb.
The Carcass.—Ordinary second-class quality; faulty in legs and scapular (merino predominating).
The Skin.—Pelt, medium; wool, good usefnl wool of strong character, a good crossbred.

No. 39.

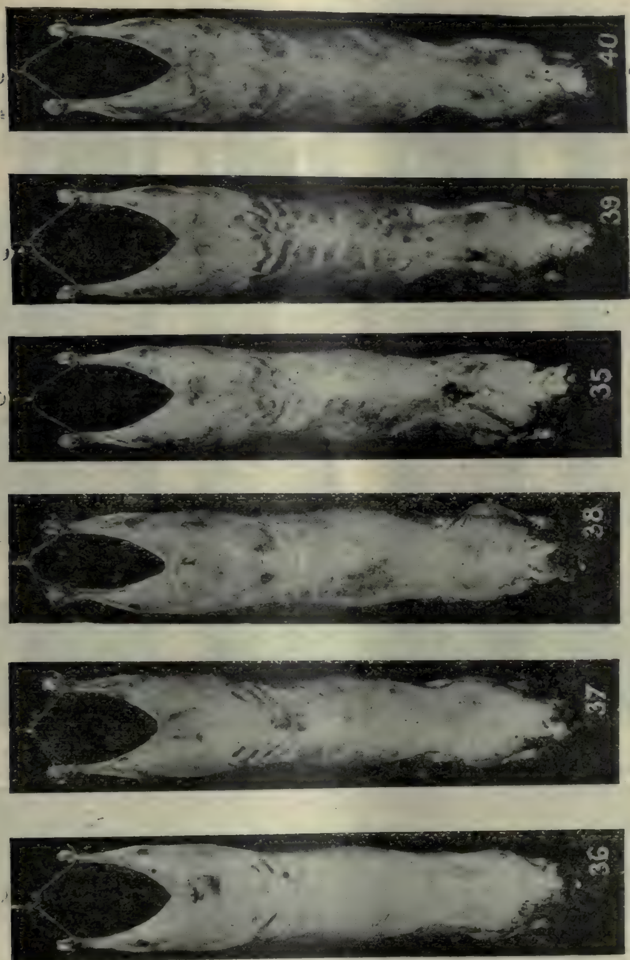
Romney-Merino—81 lb., 40 lb., 15 lb., 6 lb.
The Carcass.—Ordinary second-class quality; faulty in legs and scapular (bare of covering).
The Skin.—Pelt, medium; wool, good, good character, open staple, lacks density.

No. 40.

Dorset Horn-Merino—85 lb., 43 lb., 14 lb., 6 lb.
The Carcass.—Third-class quality (very plain).
The Skin.—Pelt, moderate; wool, fair length, fairly fine.

No. 41.

Shropshire Border-Leicester-Merino—113 lb., 59 lb., 20 lb., $5\frac{1}{4}$ lb.
The Carcass.—Good quality, nice colour; only fault rather "leggy"; very suitable.
The Skin.—Pelt, fair; wool, fuzzy, no character, short.



First Cross—age 11 months.
35. Shropshire x Merino. 36. Southdown x Merino. 37. English Leicester x Merino. 38. Lincoln x Merino. 39. Romney Marsh x Merino. 40. Dorset Horn x Merino.

No. 42.

Shropshire English-Leicester-Merino—101 lb., 53 lb., 19 lb., $7\frac{1}{4}$ lb.
The Carcass.—Prime quality; good shape, colour, &c.
The Skin.—Pelt, fair; wool, good, useful, robust.

No. 43.

Shropshire Lincoln-Merino—100 lb., 53 lb., 20 lb., $5\frac{3}{4}$ lb.
The Carcass.—Prime quality; good shape, colour, &c.
The Skin.—Pelt, good; wool, good length, useful, robust character.

No. 44.

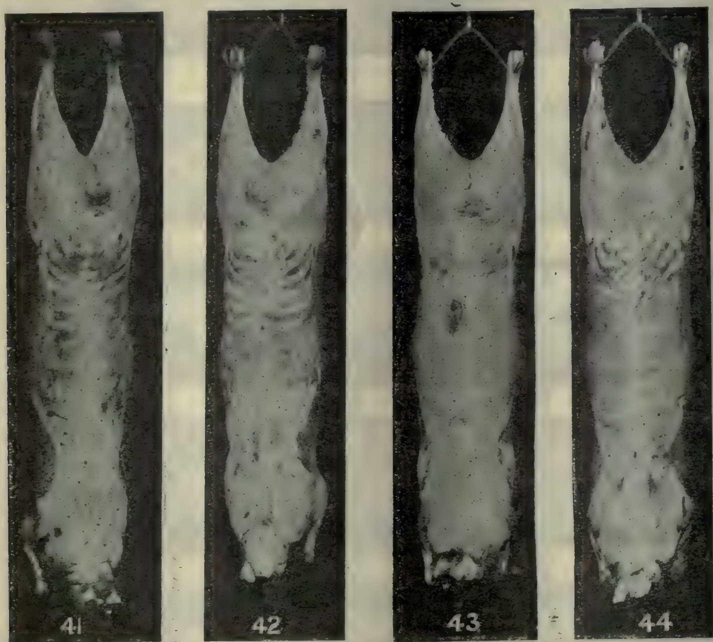
Shropshire Shropshire-Merino—99 lb., 52 lb., 16 lb 6 lb.
The Carcass.—Good quality; good shape and colour; wanting in legs and scapular.
The Skin.—Pelt, fair; wool, fuzzy, inclined to be wasty.

No. 45.

Lincoln Shropshire-Merino—103 lb., 56 lb., 16 lb., 7¼ lb.
The Carcass.—Prime quality; shape, colour, &c., perfect.
The Skin.—Pelt, good, moderate size; wool, good length, strong, good style.

No. 46.

English Leicester-Southdown-Merino—94 lb., 52 lb., 16 lb., 6 lb.
The Carcass.—Prime quality; shape and colour perfect.
The Skin.—Pelt, small; wool, nice quality, of good length.



Second Cross—11 months.

41. Shropshire x Border Leicester Merino ewe. 42. Shropshire x English Leicester Merino ewe (standard). 43. Shropshire x Lincoln-Merino ewe. 44. Shropshire x Shropshire-Merino ewe.

No. 47.

Southdown Lincoln-Merino—103 lb., 56 lb., 16 lb., 7¼ lb.
The Carcass.—Prime quality, shape, colour, &c., perfect.
The Skin.—Pelt, medium; wool, good length, useful quality; not a desirable cross.

No. 48.

Southdown Border Leicester-Merino—106 lb., 59 lb., 16 lb. 7¾ lb.
The Carcass.—Prime quality; shape, colour, &c., perfect.
The Skin.—Pelt, medium; wool, fuzzy; not a desirable cross.

No. 49.

Southdown English Leicester-Merino—92 lb., 52 lb., 14 lb. 7 lb.
The Carcass.—Prime quality; shape, colour, &c., perfect.
The Skin.—Pelt medium; wool, good length, musky, no character.

No. 50.

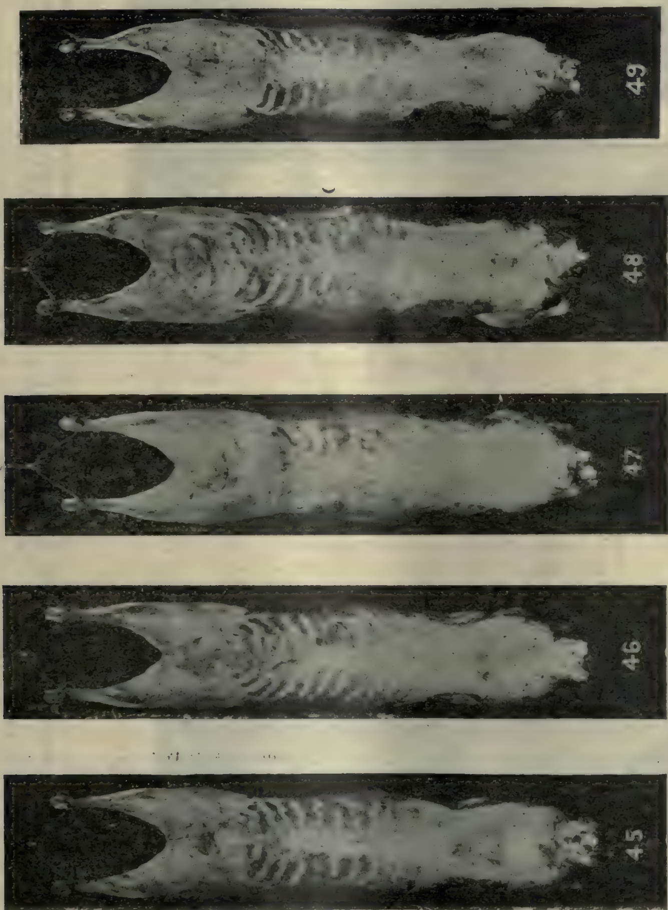
Shropshire Comeback (Lincoln)—93 lb., 51 lb., 15 lb., 5¼ lb.
The Carcass.—Prime quality; shape and colour good; only fault, lacking in leg.
The Skin.—Pelt, medium; wool, poor, fuzzy, on the short side.

No. 51.

Shropshire Comeback (Border Leicester)—87 lb., 46 lb., 15 lb., 6½ lb.
The Carcass.—Prime quality ; good shape, colour, &c.
The Skin.—Pelt, medium ; wool, short and undesirable.

No. 52.

Shropshire Comeback English Leicester)—84 lb., 44 lb., 14 lb., 5¾ lb.
The Carcass.—Prime quality ; shape and colour perfect ; a model carcass.
The Skin.—Pelt, medium ; wool, fairly good length ; useful quality.



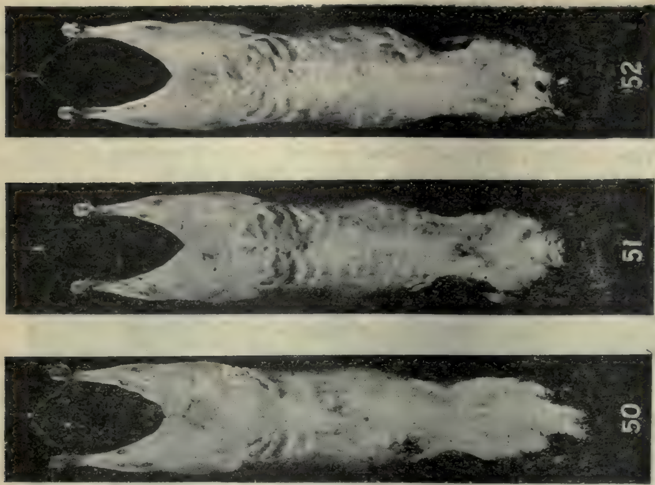
Second Cross—11 months.

45. Lincoln x Shropshire-Merino ewe.
46. English Leicester x Southdown-Merino ewe.
47. Southdown x Lincoln-Merino ewe.
48. Southdown x Border Leicester-Merino ewe.
49. Southdown x English Leicester-Merino ewe.

Mr. Wheeler, Manager of Messrs. Birt & Co.'s Cold Stores, Pyrmont, in making his report upon the carcases, concludes in the following manner:—

Of course, all these carcases of mutton and lamb are subject to a 6 per cent. reduction off the dressed weight, to arrive at the frozen weight. Also, in the dressing of the carcases for export, the kidney suet has to be neatly removed ; and in these specific carcases the weight of suet would range, approximately, 1½ lb. to 8 lb. each. Reporting collectively on these carcases as a parcel, the only fault, in my opinion, is they are too prime, and some too weighty for the British trade, with the exception of a few carcases.

(Collectively, refers to carcases from the three farms, Bathurst, Glen Innes, and Wagga.—Ed.)



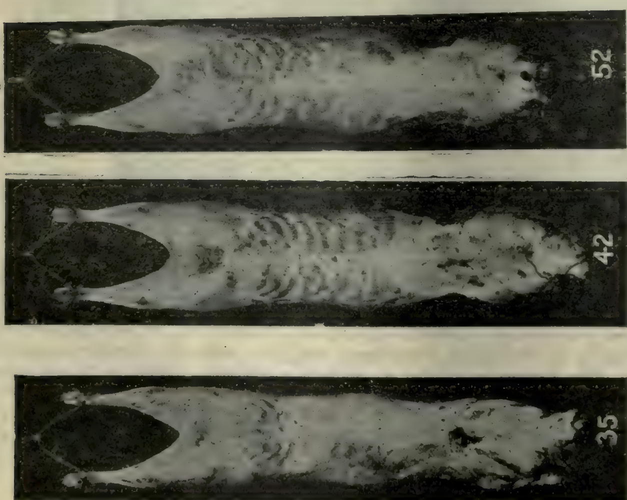
Third Cross—11 months.

50. Shropshire x Comeback ewe (Lincoln).
51. Shropshire x Comeback ewe (Border Leicester).
52. Shropshire x Comeback ewe (English Leicester).

The following are the average weights of fleeces from weaners exhibited at Show, 1908:—

12 months' growth.

		lb.	oz.
First crosses	2. Lincoln-Merino	8	10
	2. English Leicester-Merino	7	12
	2. Shropshire-Merino	7	8
	2. Southdown-Merino	7	2
Second crosses	3. Lincoln-Shropshire-Merino	8	0
	3. Shropshire-Lincoln-Merino	7	14
	3. Southdown-Lincoln-Merino	7	2
	1. Shropshire-Shropshire-Merino	6	8
	2. Southdown-Southdown-Merino	6	6
Third crosses	3. Lincoln ram on Comeback ewe (English-Leicester)	8	1
	3. Shropshire ram on Comeback ewe (Lincoln)	7	10
Comebacks	3. Merino ram on Border-Leicester-Merino ewe	11	8
	3. Merino ram on English-Leicester-Merino ewe	10	8



To compare First, Second, and Third Crosses—age 11 months.

35. Shropshire-Merino, 36 lb.
42. Shropshire x English Leicester-Merino ewe (standard), 53 lb.
52. Shropshire x Comeback ewe (English Leicester), a model carcass, 44 lb.

These fleeces were forwarded to Messrs. Goldsbrough, Mort, & Co. for report. Numbers only were attached to fleeces. No particulars were given. The following is the report:—

Fleece. Lot.	Fleece. No.	Weight of Fleece.	Breed.	Sex.	Report.
		lb.			
1	2	8¼	Lincoln-Merino	Ewe	Bright, good length and sound; the best fleece to grow from a commercial point of view, as the wool would elicit competition from all sections of the trade, and return handsomely per head.
	19	7¼	Shropshire ram on Lincoln-Merino ewe	do	
2	5	6¾	Southdown-Merino	do	Though not as good as lot 1, are of very good staple, of useful quality; always likely to bring a good price on account of good sound staple.
	6	7½	do	do	
	10	10¼	Merino ram on English Leicester-Merino ewe	Wether	
	12	9½	do Border do	Ewe	
	13	13	do do do	Wether	
	16	7	Southdown ram on Lincoln-Merino ewe	Ewe	
	31	7½	English Leicester Merino	do	
3	9	9½	Merino ram on English Leicester-Merino ewe	do	Not so fine as lot 2, but could be classed with it, being a useful wool of good weight which would command competition.
4	8	11¾	do do do	Wether	These should be very profitable fleeces to grow, as they show good staple and quality, and average good weight per head.
	11	12	Merino ram on Border Leicester-Merino ewe	do	
5	26	8	Lincoln ram on Shropshire-Merino ewe	Ewe	Well grown, but lacking the fineness of quality to make them attractive and good market wools.
	21	7¼	Shropshire ram on Comeback ewe (Lincoln)	do	
6	15	7	Southdown ram on Lincoln-Merino ewe	do	Not a good type, being far too light and wasty, and of very starey quality.
	17	7½	do do	Wether	
7	7	6½	Shropshire ram on Shropshire-Merino ewe	do	Possesses a fibre not at all attractive, and at the best of times this description meets with very poor support from buyers.
8	20	9	do Lincoln-Merino ewe	Ewe	Of good length, but lacking the necessary fineness to suit the requirements of the trade in this centre.
	22	8	do Comeback ewe (Lincoln)	do	
	25	7¾	Lincoln ram on Shropshire-Merino ewe	do	
	30	8	English Leicester-Merino	do	
9	32	5¾	Southdown ram on Southdown-Merino ewe	do	As a fleece giving a return per head, it does not compare favourably with the previous lots, being too light.
10	24	8¼	Lincoln ram on Shropshire-Merino ewe	Wether	Well grown and fairly light, but not much in demand; and taking year in year out do not compare favourably from a grower's point of view with the first four lots.
	27	7½	do Comeback ewe (English Leicester)	Ewe	
	28	9		Wether	
	29	7¾		Ewe	
11	1	9¼	Lincoln-Merino	do	Well grown, but have the disadvantage of being very wasty; would not meet with attention from buyers seeking attractive wools.
	18	7	Shropshire ram on Lincoln-Merino ewe	Wether	
12	3	7	Shropshire-Merino	do	Very light, poor yielding, and unattractive; and their uses for manufacturing purposes are limited.
	4	8	do	Ewe	
	14	7	Southdown ram on Southdown-Merino ewe	do	
	23	7¾	Shropshire ram on Comeback ewe (Lincoln)	do	

Difficulties at Parturition.

When mating Merino ewes with rams of the English breeds, considerable losses may be experienced at lambing. The young Merino ewes, bred from last season, afforded an opportunity of noting the difficulties at parturition.

The following are the particulars:—

Ewes mated with—	No. of Lambs dropped.	No. of Ewes helped.	No. of Ewes died.	Percentage of Ewes helped.	Percentage of Ewes died.
				per cent.	per cent.
Lincoln Ram	32	7	2	21	6
Dorset Horn	22	5	3	22	13
Romney Marsh	12	3	2	25	16
Shropshire	26	4	0	15	nil.
English Leicester	23	0	0	nil.	nil.
Southdown	15	0	0	nil.	nil.

No crossbred ewes were assisted.

Removal of Tails Experiment.

During the last few years an impression is abroad that the removal of lambs' tails by searing has advantages over using the knife. Several years ago the two methods were tried at this farm, and no advantage was apparent from searing. A few of the seared lambs swelled rather badly along the spine.

Last year an experiment was carried out, and the effects of the methods gauged from the weights of the lambs at different stages of their development.

The searing iron was used on twelve lambs, two each of six different crosses, and the knife used upon the same number from the same crosses. All the lambs were male. They were operated on when they were approximately ten days old.

The average weights are as follows:—

	1 Aug., 1908.	1 Sept.	1 Oct.	1 Nov.	1 Dec.
Knifed	$19\frac{2}{3}$ lb.	$27\frac{5}{6}$ lb.	$37\frac{1}{4}$ lb.	$46\frac{2}{3}$ lb.	$57\frac{3}{4}$ lb.
Seared	$19\frac{3}{4}$,,	$27\frac{1}{4}$,,	$36\frac{2}{3}$,,	$46\frac{3}{4}$,,	$57\frac{1}{6}$,,

The above figures do not show any advantage from searing, though the seared are rather at a disadvantage, but the very slight differences are not sufficient to warrant the assumption that it interfered with their development.

Appendix.

The following are the particulars of difficulties at parturition for lambing, 1909. The figures are for Merino ewes only:—

Ewes mated with—	No. of Lambs dropped.	No. of Ewes helped.	No. of Ewes died.	Percentage of Ewes helped.	Percentage of Ewes died.
				per cent.	per cent.
Lincoln Ram	18	6	0	33·3	0
Romney Marsh	19	7	1	36·8	5·2
Dorset Horn	18	5	0	27·7	0
English Leicester	37	1	0	2·7	0
Shropshire	10	3	0	30	0
Suffolk	10	1	0	10	0

The Harvesting of Malting Barley.

The value of malting barley is governed very largely by the manner in which the grain is harvested and threshed.

The leading brewing firms and maltsters are unanimous in their opinion that New South Wales malting barley, grown on friable, warm, naturally well-drained soil, and harvested with due regard to the requirements of the maltster, is equal to any; but in view of the shortage of local supplies, it is necessary to import a very large quantity from other States and New Zealand. The total quantity of good malting barley grown in New South Wales last year was scarcely equal to 25 per cent. of the quantity that the Sydney brewing firms use in twelve months.

It is therefore obvious that there is an excellent and assured market, and it will be well worth the while of all growers to pay careful attention to every detail of harvesting. For their guidance the following advice has been obtained from the most experienced and competent authorities.

Mr. Arthur Tooth, of the firm of Messrs. Tooth & Co., Limited; Mr. Chas. Redwood, head maltster of Messrs. Toohey, Limited; Mr. Britten, of Tamworth; Mr. R. W. Peacock, manager of the Bathurst Experiment Farm; Mr. F. B. Guthrie, Chemist; and many other authorities, point out that it frequently happens that a promising crop of barley is rendered useless for malting by careless harvesting or improper threshing. Mr. Tooth emphasises the necessity for harvesting in such a way as to secure the whole of the grain at the proper stage of maturity, and thus produce an even sample. The following notes by Mr. Chas. Redwood, head maltster of Toohey, Limited, are the outcome of a large and very extended practical experience under local conditions, and the attention of barley-growers is specially directed to the sound advice offered.

Harvesting Machinery.

Mr. Redwood says:—"Barley may be harvested either with the stripper or stripper harvester, or with the reaper and binder. As barley in the stack undergoes a sweat which mellows it and induces the even germination essential for malting purposes, the use of the reaper and binder is recommended. In some cases where only stripping machines are available, farmers should be very careful to employ skilled drivers, otherwise in the process of stripping the grain becomes skinned and broken, and is thus useless for malting.

Cutting.

"Barley should be ripe, but not overripe—that is, the grain should have attained its full size, which will take place just before it is hard, while there

is sufficient sap in the straw to prevent shedding. Nothing is gained by cutting barley dead ripe; on the contrary, the quality is impaired for malting purposes, and fully one-fourth of the best grain will be left in the paddock.

Stooking.

"Barley should be immediately stooked; if not, some of the grain will be discoloured, and should rain come will quickly germinate. The time barley ought to be in the stook depends much upon the weather, but it should never be stacked until thoroughly dry.

Stacking.

"This is a point that requires great care. The best results, from a malting point of view, are obtained in large stacks, as there is less outside, and the mellowing process is more complete. If barley is not dry when stacked, it will heat and become mow-burnt, destroying its germinating powers, which renders it useless for malting purposes, as barley must germinate to make malt. It is greatly improved by being kept a couple of months in the stack.

Thatching.

"Having built your stack, it is very important to secure it from rain. This can only be done by using some cover, because barley is not like wheat and oats, that can be built to resist the weather. The straw of this cereal is of a soft spongy nature, and cannot be secured without some protection from the weather.

Threshing.

"One may have a perfect sample of grain and then have it fatally injured in the threshing. The revolution of the drum should be at least 200 less than that required for threshing wheat, and the concave of the machine must not be set too close to the drum, or it will break and bruise the skin of the barley, and nip the awn off too closely, which renders the grain practically useless for malting purposes. The concave of the drum should be well open at the top and closed up tightly at the bottom, so that the last stroke of the drum may give the straw a final pinch. No matter how perfect the grain is, mould must develop during the germinating process. To avert this, in threshing it is far better to leave a few awns on the barley, which is not detrimental to the grain in the slightest degree. If the barley is found to be smutty, do not put it through the 'polisher,' but through the 'screw,' as then the smut bladders are not broken, and the grain does not get discoloured as it would otherwise. Still, there should be no smut at all if the pickling is properly attended to. Barley seldom requires putting through the 'polisher.' Be sure and open the screen and take out both seconds and thirds, in order to secure an even sample. It must be borne in mind, if this is not done the inferior grain has to be taken out at the malthouse, and in purchasing barley the maltster always takes this into consideration, and I can assure the farmers that it is to their interest to have their barley well screened. To do this it is necessary not to thresh too fast.

Storing.

"I wish to call the farmers' attention to this matter, as it is a source of considerable trouble to the maltster. Many farmers store their barley in weevily bags or barns; hence the barley becomes infested with weevils, which are brought direct to the malthouse. I have rejected good samples of barley from this cause. The weevil during the summer months breeds very rapidly, and farmers cannot be too particular on this point.

Characteristics.

"I will now try to describe the characteristics which constitute prime malting barley. For malting purposes I group the qualities of barley as follows:—Four essentials and six non-essentials. The four essentials of barley needed to make first-class malt are: Vitality, condition, maturity, and odour. The desirable non-essentials: Size, weight, uniformity, colour, appearance of skin, and age. I will now describe the four essentials which are absolutely necessary in barley for the production of fine malt.

Vitality.

"This is the first and most important feature, as without life you can do nothing. By vitality is meant not only the simple power of growing, but of developing rootlets and acrospire with uniformity. There are many causes which affect the vitality of barley. Irregular growth arising from varied circumstances prior to ripening, death of germ caused by overheating in stack, improper storage in barn, destruction by weevil, partial or total destruction by threshing, loss of vitality through age and dampness. Barley is no good for malting purposes after it is eighteen months old. It will start germinating on a malting floor, but after two or three days will cease; and to make malt it would require to grow for about six to seven days, or even more. Hence the importance of vitality. Next in rank comes

Condition.

"The word condition signifies or embraces the following good qualities:—Softness or mealiness, colour of inside, and also the following bad qualities, viz.: Steeliness, hardness, horniness, flintiness, glossiness, coldness, humidity, mouldiness, whether derived in field, stack, or barn, dirtiness, and also damages arising from reaping, threshing, &c.

Maturity.

"Maturity is distinct from the age of condition, and refers to greenness, ripeness, or overripeness. Now we come to the last of the indispensable characteristics of barley that are qualified to produce first-class malt. That is a good and proper odour.

Odour.

"Barley that has an unhealthy smell can never produce a first-class malt, no matter how skilfully it may be worked or cunningly doctored. Sound, pure, untainted barley has a peculiar, clean, slight odour, almost imperceptible, and difficult to describe in words. However, once learned, it is ever afterwards readily recognised."

Mr. Redwood adds that the question of soil is of the utmost importance. He says it is impossible to grow good barley in heavy, waxy, wheat land, whereas in many large tracts where the lighter quality of soil will produce only indifferent wheat crops, good yields of barley may be obtained. In illustration of this he cites the case of a farmer who, having failed repeatedly to get a satisfactory return from wheat, tried barley. His first crop returned 70 bushels per acre, and samples from it forwarded to Great Britain secured the first prize for malting barley at the Brewers' Exhibition in London.

The writer has in four successive years attended the Brewers' Exhibition in London, and has thus had opportunities of obtaining the opinions of some of the foremost British experts as to the quality of New South Wales barley. The opinion generally expressed was to the effect that our barley is of good quality, but that the unevenness of some of the samples betrayed lack of care in the harvesting and get-up. Several prominent experts said that there appeared to be no reason why New South Wales should not become a big exporter of high-grade barley, for which the demand in Great Britain is always good.

It will be of interest to barley-growers to know that Messrs. Toohey, Limited., with a view to encouraging farmers to devote more attention to this crop, have decided to offer substantial cash prizes at the next Annual Show of the Royal Agricultural Society for exhibits representative of bulk samples of malting barley. Messrs. Tooth & Co., Limited, have also arranged to offer a prize at the same exhibition.

Cumberland Fruit Districts.

Mr. Sam. Moore, Junr., Inspector of Orchards in Dural and surrounding districts, reports that the prospects of the fruit crops throughout his district are particularly good. The trees of all varieties are in good condition, and are all carrying heavy crops of fruit.

Lucerne Hay-making.

G. COBB, Farm Foreman ; A. H. E. McDONALD, Instructor of Agriculture,
Hawkesbury Agricultural College.

LUCERNE is more difficult to cure and greater loss occurs when improper treatment is given than in the case of any other kind of hay crop. Careful handling is required from the time the crop is cut until the hay is baled for market. Examination of the different lots of lucerne hay found any day in the city markets shows that a very serious deterioration in quality occurs through lack of attention to what are apparently minor details. The eagerness with which buyers snap up well cured lots of lucerne indicates the importance of curing and marketing hay in the very best conditions. They prefer hay which is bright, green, dry, free from weeds and other rubbish, and contains a large proportion of leaf. A dirty appearance indicating careless handling in the field or the slightest sign of heating in the bale causes buyers to reject the lot or to only accept it at much reduced prices. What otherwise would have been excellent samples of hay have been rendered valueless through heating after it has been put in the bale. Buyers who have to store the hay do not care to take risks, and are very careful in buying. So keen are they in this respect that slight indications are taken as a guide in their buying, and a good deal of reliance is placed upon external appearances. This is especially so if supplies are large and an attractive appearance will help to move off a lot freely. Too much importance cannot be attached to this point because it means an actual loss of large sums to the farmer each year. Produce of prime quality sent into the market in dirty packages, or in the case of hay in rough untrimmed bales, does not look or sell so well as even inferior stuff put up in an attractive way.

To obtain the best quality in lucerne hay the work must commence with the selection of the right time to cut and continue right through until the produce is on the trucks for market. Lucerne is raised chiefly in this State for sale as hay, and the remarks herein are meant to suggest how it can best be prepared. On many farms it is now grown for dairy cows, and when not fed as green feed is used as hay. Since quality is essentially of the same importance when lucerne hay is fed on the farm as when placed on the market the method of converting it into hay is substantially the same.

The Time to Cut.

Lucerne should be cut just after the first flowers have appeared. The usual rule is to cut when about one-tenth of the flowers have appeared. Much more depends upon the selection of the right time to cut lucerne than other hay crops. In their case loss is chiefly due to deterioration in digestibility, but in lucerne the loss is not confined to this but extends to actual loss of

weight in the hay and to poorer growth in the succeeding crop. After lucerne flowers the nutriment in the stems and leaves is withdrawn and transferred to the upper portions of the plant, and the stems harden and become indigestible and of less value as food. The palatability of the hay is injured and stock do not relish the feed so well as that cut at a younger stage. The value of this is well known, especially to those who have had to feed damaged foods to stock. The leaves wither and begin to fall, and result in loss of weight. These are the richest portion of the plant, and every effort should be made to retain them in the hay. No advantage is obtained when the crop is allowed to remain uncut past the stage recommended. The only time when such a course is justifiable is when the weather is unsuitable for hay-making, and the crop is left standing until good weather is assured. A loss in the succeeding cuttings follows when cutting is left past the time indicated. This loss is due to two things. When the crop is left uncut until past flowering it is found that the succeeding crop does not start away so quickly as it does when the cut has been made when the plants are just flowering. At this time young shoots commence to grow from the bottoms of the stalks, and if cutting is deferred these are cut and the succeeding crop is slower in making a start. Secondly, loss occurs through the greater time which the crop occupies the land. Lucerne only grows during the summer, and, provided rain is plentiful, good crops can be obtained at frequent intervals. If the average time for a cut of lucerne be taken at six weeks, and five cuts are obtained in a season of thirty weeks, it means that if the cut is allowed to stand seven weeks only four cuts can be obtained. This means an actual loss of 15 cwt. to 1 ton of hay per acre per annum, as during the extra week that the crop stands in the field no increase is made in the yield, but rather a decrease results, owing to the loss of leaves. It frequently happens that owing to the cool weather the first growth of the season does not flower early, and the leaves begin to drop and the stems to harden before the bloom appears. The crop should be carefully watched and the cutting made when the lower leaves begin to change their colour.

Cutting.

This is done with the mower or scythe. A time should be selected when the crop is at the right stage, and when there is a prospect of fine weather lasting until curing is completed. Showery or cloudy weather renders curing very difficult, and hay of the best quality cannot be made. The usual practice is to start the mower going in the morning as early as possible, but if a heavy dew is on the crop cutting should be deferred until it has evaporated. External moisture owing either to rain or dew is objectionable, and causes deterioration in the quality of the hay.

Drying.

If the day continues fine the rake should be started about mid-day, so that the cut crop will be raked into the windrows before nightfall. Hay should not be allowed to lay in the swath too long, especially in hot, scorching

weather, when it should be put into the windrows almost immediately after cutting. The heat causes a rapid drying of the tender leaves, and these become quite dry, while the stems are still sappy. When the hay gets into this condition in the swath a large amount of the leaf will shake off when raking into the windrows, and in cocking. In good hay the quantity of leaf ranges from 45 to 50 per cent., and as it is considerably richer than the stems in nutriment a very serious loss in both quality and quantity may occur through careless handling. After the hay has wilted a few hours in the windrows it should be put into cocks. The time it is left varies according to the condition of the weather. In cool, fine weather it may be left in the windrows about half a day, while in hot, scorching weather it should be put in cocks almost immediately. In cloudy, dull weather it is left in the windrows from one to two days. Drying is done to remove the excessive quantity of moisture, and to get the hay in such a condition in the field that when stacked it will not heat too much nor become mouldy. The moisture is removed by the heat and wind drawing off the moisture directly as it is removed from a wet cloth or by the leaves transpiring the moisture as they do when the crop is growing. Heat is liable to cause too rapid drying of the tender leaves, causing them to become too dry while the stems are still insufficiently dry. The hay dries best when the activity of transpiration in the leaves can be maintained. This gradually exhausts the moisture of the stems, and the curing takes place more evenly. This natural transpiration of moisture is obtained by putting the hay into cocks soon after raking into windrows. The leaves in the cocks are protected from the direct rays of the sun and are not scorched. By following this plan the loss both of quality and quantity is materially reduced. Hay cured in the cocks in this way is sure to keep well in the stack, while if dried in the swath or windrow it is almost sure to blacken or burn. The cocks should be made narrow and high rather than broad and flat. In wet, muggy weather moulding or heating is liable to start in the cocks, especially where leafy, sappy stuff is handled. To obviate this danger the cocks should occasionally be gently moved to let in the air. Just before stacking the cocks are sometimes moved to expose the lower hay, which is inclined to be slightly damp. Exposure to the air for an hour or two soon drives off the moisture and puts the hay in a proper condition for stacking. The time the hay is allowed to remain in the cocks depends upon the weather conditions. In fine, hot weather it can be stacked two days after cutting, while in cool weather three to four days are necessary. Care has to be taken that it is not stacked whilst so damp that combustion or mould will occur in the stack, but, on the other hand, it is equally important that it does not become so dry that its palatability, digestibility, weight and appearance are injured. It is an operation in which some experience is required to secure the best results. A farmer with a large quantity of valuable hay lying in the field is tempted to bring it in too early to avoid the risk of damage from rain, while in good drying weather he is tempted to leave it longer than necessary to avoid the risk of loss in the stack. It must be remembered that good colour is of great importance,

and by leaving it too long the hay on the outside of the cocks will bleach and lose its green colour, and seriously affect the appearance of the whole of the hay. Generally speaking, good drying weather can be obtained in most of the lucerne-growing districts of the State, and the chief danger to provide against is overdrying. In the more advanced States of America a practice is now being adopted of protecting the hay whilst drying with hay caps, made either of canvas or cloth. These caps are made about 4 feet square, and the sides hemmed to prevent fraying. Holes are made in each corner to receive strings, which can be tied to pins which are either pushed into the ground or under the hay to prevent the cap blowing off. In districts where the weather is not suitable for drying, these caps are doubtless very useful for protecting rich food against conditions which cause deterioration in quality.

Stacking.

It is almost impossible to indicate exactly when the hay is at the right stage for stacking. Little danger exists of insufficient drying of the leaves; the chief danger exists in the stems. These should be examined carefully to ascertain whether they have lost their sappiness. If they are sappy and moist the hay should not be stacked. Generally it is right to bring in when if felt it has a crisp feel rather than a dead damp feeling. Lucerne hay should preferably be stored in sheds. It does not shed rain well, and should never be stacked in the open unless thatched or otherwise covered to protect it from rain. Storing in sheds, besides being more convenient, has the advantage that when baling or feeding no damage can be done to the hay by rain or heat. Before building, a foundation of poles should be laid down to give ventilation to the bottom of the stack; if stacked on the ground, some of the hay is sure to spoil. In building the stack, the centre should be kept high, so that rain will not run in from the sides.

Spontaneous Combustion.

Lucerne hay, under some circumstances, is liable to become so heated in the stack that firing occurs, and the hay is reduced to ashes. In other cases heat is generated, but is not sufficient to cause firing, and the hay is only charred. The degree of charring varies according to the temperature reached, and in some cases is so slight that the hay is not materially damaged, while in other cases it may be so great that the hay is rendered practically valueless as feed. The direct causes of spontaneous combustion are rather obscure, as also are the conditions which are conducive to its development. As a rule, however, it is found to occur in hay which has been made from heavy, sappy crops, especially if it is made when the weather is not suitable for drying. Great difficulty is experienced in getting the moisture out of very green lucerne, and even when the stuff is apparently dry charring or combustion may occur. When the crop is very sappy, and the weather not favourable to drying, the hay should be put up in narrow cocks and left in the field until no trace of moisture can be detected. Generally it is the first cutting of the season which

causes the trouble, as it grows during cool weather and contains a larger percentage of moisture than later cuts. Extra care should be taken with this, and, if necessary, the hay stacked outside and away from sheds or barns, so that, should combustion occur, they will not be destroyed.

Baling.

Although baling is sometimes done direct from the field, or very soon after stacking, the practice is not a good one. Curing is not completed in the field, but continues in the stack, and time must be allowed for it to sweat and mellow before baling. If hay which has not had time to sweat is put into tightly compressed bales, rapid heating is induced, and the slightest suspicion of heat will cause buyers to reject it. Hay has been seen in the city stores which had become so hot that the hand could not be kept in the bale more than a few seconds without pain. Such hay rapidly becomes unfit for feed, and it is a pity to see what in other respects is first-class feed spoiled simply by baling when not fit. Of late the old large size bale has fallen into disfavour, and many buyers now prefer a smaller sized bale.

Battens.

Quite recently the question of weight of battens has provoked some discussion, and a good deal has to be said on both sides. Buyers do not object to reasonable size battens, but it must be said that they have cause for complaint in the size of some of the battens which are used. It is to the farmer's own interest to put his produce up in such a way that it will command the best price, and it is absolutely certain that if he does not send his produce to market in a proper condition a fair price will not be realised. The buyer is willing to give a good price for stuff which is good right through, but when he sees anything which is likely to depreciate its value, he allows a margin for risks, and it is generally a margin which lands him well on the safe side. The keenness with which buyers note the different brands of produce on the market is indicative of their desire to be sure of the quality of the stuff they buy. Good known brands are snapped up readily because they have been proved by experience. The history of the chaff market, the millet market, and others show that nothing but loss results to the farmer whose produce is not put on the market in a good condition. Only a walk through the markets when the sales are on is needed to convince an observer of the value of putting produce on the market with a good appearance, and put up generally in an attractive and honest way.

Government Stud Bulls available for service at State Farms, or for lease.

Breed	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Pansy Duke ...	Earl March ...	Pansy 4th ...	Wollongbar Farm.	*
,, ...	March Pansy ...	Earl March ...	Australian Pansy	Grafton Farm ...	*
,, ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd.	Berry Farm ...	*
Jersey ...	Thessalian II ...	Thessalian ...	Egyptian Princess	Alstonville ...	*
,, ...	Golden Lord ...	Golden King ...	Colleen ..	Wagga Exp. Farm	*
,, ..	Sir Jack ...	Omelette's Pride	Lady Tidy 3rd (imp.).	Berry Farm ...	*
,, ..	Berry Melbourne	Melbourne ...	Rum Omelette	Mt. Irvine, Bell ...	*
Guernsey ...	Gentle Prince ...	Rose Prince ...	Gentle ...	Alstonville ...	19 Jan., '10.
,, ...	Prince Edward..	Rose Prince ...	Vivid ...	Wyrallah	13 May, '10.
,, ..	Star Prince ...	Calm Prince ...	Vivid ...	Alstonville District	17 Dec., '09.
,, ...	Prince Souvia ...	Vivid's Prince...	Souvenir ...	Wollongbar Farm.	*
,,	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Paterson District	22 Jan., '10.
Red Poll ...	The Judge ..	Barrister ...	Lovely 8th ...	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General... ...	Judy 9th ...	Bathurst Farm ...	*
,, ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
,, ...	Auchenbrain Spicy Jock (imp).	Howie's Spicy Robin.	Another Mayflower	Berry Farm ...	*
,, ...	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
,, ..	Jamie's Ayr ..	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
,, ...	Emerald's Mischief.	Prince Emerald	Miss Prim ...	H.A. College, Richmond	*
,, ...	Dado	Daniel	Dot	H.A. College, Richmond	*
Kerry	Bratha's Boy ...	Aicme Chin ...	Bratha 4th ..	Glen Innes Farm...	†
,, ...	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Dexter Kerry	Waterville Punch	....	.. ..	Grafton Farm ...	*
Holstein ...	Obbe II ..	Obbe	La Shrapnel...	Wollongbar Farm	*
,, ...	Hollander ...	Bosch III ..	Margaretha ...	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

Tobacco Notes.

A Warning to intending Growers of Cigar Leaf.

The Managing Director of the States Tobacco Company, Melbourne, chiefly engaged in the manufacture of cigars, states that for some years past his company has been actively interested in promoting the cultivation of cigar-leaf in some of the northern districts of New South Wales and Queensland. Among other measures to this end, the company brought out, three or four years ago, a practical cigar-leaf expert from Connecticut, U.S.A. This gentleman, Mr. H. F. Farnham, visited many farmers in the districts mentioned, distributing seed and literature and imparting practical knowledge to farmers, with the result that experimental lots of leaf were grown on a number of holdings and sent down to the company. Although the prices paid for the leaf were fair, if not liberal, and were so admitted to be by growers, the quality of the New South Wales tobacco was not promising, and the venture, as far as the New South Wales farmers were concerned, was not a success, and was wisely abandoned.

Better results attended experiments in Queensland, at Bowen, where a promising type of cigar-leaf has been produced in increasing quantities during the last two or three years, and for which as high as 1s. 6d. per lb. has been paid for parcels this season.

Last year the bulk of the Bowen tobacco brought 1s. per lb., which, together with the Federal bounty of 2d. per lb., left a handsome margin of profit to the grower.

The news of last year's price has evidently spread to some of the northern districts of New South Wales, for this year we are beginning to receive shipments from that quarter, particularly the Manning River district, Kimbriki, &c., and it is probable when this year's still higher prices for Bowen leaf are published far and wide that farmers in those districts may take up cigar-leaf cultivation, in the expectation of receiving prices similar to those we have been paying for Bowen leaf.

As the demand in Australia for cigar-leaf is limited, and scarcely likely to exceed 50 tons per annum for some time to come, and as it is highly probable that the tobacco from Bowen, which has been proved to be superior to others, may more than fill these requirements, intending growers of cigar-leaf in districts in this State that are not possessed of all the conditions favourable to the production of leaf of the requisite quality will be well advised to make careful inquiries before undertaking the production of a crop for which there may be little or no demand.

In the opinion of leading Australian manufacturers, no good plug-leaf can be grown on the coast within 20 to 30 miles of the sea, probably owing to salt in the air, whereas there has been some excellent leaf produced this season at Manilla and other places in the Tamworth district.

Types of Tobacco.

In connection with the efforts being made by the Department of Agriculture to stimulate interest in tobacco culture, Mr. John Gilmour, of Messrs. W. D. & H. O. Wills (Australia) Limited, states:—"That some of the types of tobacco of which seed was imported by the Department are unknown to him, owing to names changing so often.

"White-stem Oronoko is well-known and has done better than any other plug tobacco seed ever introduced to Australia. It is possible to get from this variety lemon-coloured cigarette leaf by flue-curing, as well as mahogany wrappers and filler, and it is doing remarkably well at Texas, Queensland. Messrs. Wills (Limited) have distributed samples of this seed to nearly every grower in this State.

"Slate's Improved White-stem Oronoko should be much about the same type as the above, but we have not tried it in Australia yet. Yellow Oronoko should also be a good type, but I am not acquainted with it. We know more about Yellow Pryor and Yellow Mammoth, which we think pretty much resemble it, and would prefer Yellow Pryor, because it is doing remarkably well in Texas, Queensland.

"Connecticut Seed Leaf and Slate's Improved Connecticut Seed Leaf are cigar types, the former being the original seed sown in Tumut. Grown year after year it gradually became an altogether different type of tobacco, being now very coarse and heavy, and quite out of date. It was grown for over thirty years on the rich alluvial flats of Tumut, and developed into a very heavy tobacco—too heavy in fact for plug tobacco. There are two better types for cigar leaf—Comstock Spanish and Zimmer Spanish, both of which are doing well in Bowen, Queensland.

"The types that have proved most suitable to Australia for plug tobacco are: White Stem Oronoko and Yellow Pryor; and for cigar leaf—Comstock Spanish and Zimmer Spanish.

"Speaking from many years' experience, I am convinced that we cannot, from the same seed, produce in Australia the same tobacco that they do in America. Tobacco is indigenous to America, and every country has its own peculiar characteristics; the tobacco plants will change accordingly. We can grow in Australia from American seed tobacco *like*, but not the *same*, as the original, and I have noticed that even the *likeness* begins to run out in three or four years; hence all tobacco seed should be renewed about every four or five years, as the American types take on Australian characteristics.

"We are now, however, getting better tobacco leaf from lighter soils, and when the alluvial flats, on which a lot of our leaf is grown, become poorer, we may get nearer to retaining original types, although I am not at all sure that there is such a thing as permanency of type in tobacco."

Orchard Notes.

W. J. ALLEN.

NOVEMBER.

Orchard Pests.

FROM now until the harvesting of the fruit is completed, continuous warfare will have to be waged against the codling moth, and no effort should be spared to help keep this and other pests under. Every grower of apples and pears should spray with arsenate of lead, and only well-known brands of this should be used extensively, until the newer brands now being introduced on the market have been thoroughly tested, and it has been proved beyond a doubt that they will not damage the fruit or foliage, and that their effectiveness against pests is at least equal to the already-tried brands. Last year there were a good many complaints made by growers who tried to make their own arsenate of lead, or who got their local chemists to prepare same for them. In some cases it burnt the leaves and damaged the young fruit, while in a few instances it destroyed the whole crop. Swift's arsenate of lead does not damage either trees or fruit when mixed in the proportion of 2 lb. to 50 gallons of water, but we want competition, and if only one firm make a suitable arsenate of lead, they may feel inclined to raise the price. We are paying quite enough for it now, and it is hoped that for large quantities (28 lb. or over) it will not be long before the firms handling same will see their way to lowering the price, and thus bring it within the reach of all growers.

In addition to spraying at intervals after the petals have fallen, all fallen and infested fruit must be picked up and boiled or burnt, and any infested fruit which may be seen hanging on the tree should be picked and destroyed in a similar manner.

Bandaging.

Occasionally one sees on trees bandages which resemble stockings, and which in place of being tied or pinned on, are sewn on. As bandages are required to be removed and examined every week, securing them with a nail or strong string gives general satisfaction.

Scale Insects on Citrus Trees.

Red and other scales of the citrus trees should receive attention. These may either be sprayed or fumigated in accordance with directions given in published tables, copies of which may be obtained by applying to the Department of Agriculture.

Fungus Diseases of the Apple and Pear.

Powdery mildew or black spot may make their appearance in some of the damp districts. In such cases the trees should be sprayed with Bordeaux

mixture as a preventive as soon as the buds have begun to swell in the spring, with occasional sprayings after the fruit has set, but such spraying should be carried out with the utmost care, as it is not uncommon for bluestone to mark the fruit, if applied at all strong.

Bluestone 6 lb., lime 4 lb., diluted in about 60 gallons of water, is about the proper strength. Some make it a little stronger by diluting in 50 gallons of water, but this strength has been known to damage Jonathan, Perfection, Five Crown, and a few other varieties. Directions for mixing may be had on application to the Department of Agriculture.

Fruit Fly.

In districts where the fruit fly has been troublesome in previous seasons particular care should be taken to pick up and destroy all fallen fruit by boiling, in order to ensure the destruction of all larvæ which may be contained therein. Should the fly appear, set kerosene traps. At present these are the only sure ways known of helping to keep down this pest, and I would urge upon growers the importance of doing their best in this respect.

Inspectors have now been appointed in different parts of the country with instructions to see that all growers are using every reasonable precaution to keep the codling moth and fruit-fly in check; but we hope that by this time every grower is convinced that it is to his own interest to co-operate with his neighbours in using every means to stamp out these pests, and I feel sure that if they work with a will the fruit industry will soon be in a much better position than it has been in the past.

Disbudding.

See that all superfluous growth is removed from the roots and trunks of all trees and vines, so that the new growth will be confined to the development of limbs and canes which have been selected to form the main arms and branches of such tree or vine. It is regrettable to see suckers growing from the roots of many trees and vines which could, with a very little trouble, have been removed, when such misguided energy would have gone towards the development of the tops of such plants.

Summer Pruning may be started this month, and it is well to go over and regulate the growth of all young trees, thinning and shortening back where required—that is where the tree is growing too thick; and pruning or pinching back so as to keep the tree evenly balanced and symmetrical. This early summer pruning is more for young trees, to aid in directing the growth to that part of the tree where it is most required.

Pruning of citrus trees may be continued wherever not completed.

Pruning and manuring of passion fruit vines may be carried out during the early part of this month.

Whenever Thorny mandarins show signs of cropping too heavily it will be well to prune them a little more severely, as well as removing some of the fruit from the tree, so that the latter will not overbear and exhaust itself this season. If allowed to overbear the fruit will be small and almost worthless.

Cultivation.

It is most important that the culivation of the soil should receive special attention at this season of the year, as keeping the ground well worked to a depth of several inches prevents evaporation. After each rain or irrigation the whole of the orchards and vineyards should receive a thorough cultivation immediately the ground is dry enough. Do not wait until a hard crust forms on the top of the soil, but put on all available help and have the surface broken up immediately. Keep the trees and vines well worked around with a fork hoe or pronged fork. The plough should never be brought into requisition at this time of the year, except, perhaps, in a very wet, cool district, but the soil should be kept stirred to a depth of 4 or 5 inches with a good cultivator.

Irrigation.

Where irrigation is practised a thorough watering should be given to all trees towards the end of the month. This should be the second watering of the season. Be most careful to keep the water confined to the furrows, as wherever the land is flooded it is likely to become hard. As soon as the furrows are dry enough to work cultivate the orchard twice and loosen the soil around any young trees with a fork hoe.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1909.

Society.	Secretary	Date.
Lismore A. and I. Society	T. M. Hewitt	Nov. 17, 18, 19
Tweed and Brunswick A. Society	F. A. Wildash	,, 24, 25
Berry Agricultural Association	C. W. Osborne	Dec. 8, 9, 10

1910.

Society.	Secretary	Date.
Albion Park A. and H. Society	Hector G. Fraser	Jan. 19, 20
Kiama A. Association	R. Somerville	,, 26, 27
Wollongong A., H., and I. Association	F. W. Phillpotts	Feb. 3, 4, 5
Shoalhaven A. and H. Association, Nowra	Henry C. Rauch	,, 9, 10
Coramba District P., A., and H. Society	H. E. Hindmarsh	,, 16, 17
Alstonville A. Society	W. Monaghan	,, 16, 17, 18
Nambucca (Macksville) A. and H. Association	R. Turnbull	,, 16, 17, 18
Kangaroo Valley A. and H. Association	E. G. Williams	,, 17, 18
Queanbeyan P. and A. Association	E. C. Hincksman	,, 17, 18
Guyra P., A., and H. Association	P. N. Stevenson	,, 22, 23
Tumut A. and P. Society	E. H. Vyner	,, 23, 24

Society.	Secretary.	Date.
Manning River A. and H. Association...	S. Whitbread	Feb. 23, 24
Ulladulla A. Association...	J. Boag	,, 23, 24
Bellinger River A. Association ...	S. S. Hindmarsh...	,, 23, 24, 25
Gunning P., A., and I. Society...	W. T. Plumb	,, 24, 25
Robertson A. and H. Society	R. G. Ferguson	,, 24, 25
Wyong Agricultural Association	Edgar J. Johns	,, 25, 26
Tenterfield Intercolonial P., A., and M. Society	F. W. Hoskins	Mar. 1 to 5
Narrabri P. and A. Association ..	W. H. Ross	,, 1, 2, 3
Tamworth A. Association	J. R. Wood	,, 1, 2, 3
Yass P. and A. Association	Will Thompson	,, 2, 3
Braidwood P., A., and H. Association	L. Chapman	,, 2, 3
Coraki A. and H. Society	D. Cameron	,, 2, 3
Bega A., P., and H. Society	W. A. Züegel	,, 2, 3, 4
Nepean District (Penrith) A., H., and I. Society	Percy J. Smith	,, 3, 4
Berrima District A., H., and I. Society	....	,, 3, 4, 5
Murrumburrah P., A., and I. Association	J. A. Foley	,, 8, 9
Bangalow A. and I. Society	W. H. Reading	,, 8, 9, 10
Central New England P. and A. Association (Glen Innes), National Show.	Geo. A. Priest	,, 8 to 11
Tumbarumba and Upper Murray P. and A. Society	E. W. Figures	,, 9, 10
Quirindi District P., A., and H. Association...	W. Hungerford	,, 9, 10
Campbelltown A. Association	Fred. Sheather	,, 9, 10
Mudgee Agricultural Society	H. Lamerton	,, 9, 10, 11
Warialda P. and A. Association	A. J. Devine	,, 9, 10, 11
Crookwell A., P., and H. Association...	M. P. Levy	,, 10, 11
Port Macquarie and Hastings District A. and H. Soc.	W. R. Stacy	,, 10, 11
Oberon A. and P. Society	W. Minehan	,, 10, 11
Newcastle A., H., and I. Association	C. W. Donnelly	,, 10, 11, 12
Cobargo A., P., and H. Society	T. Kennelly	,, 11, 12
Blayney A. and P. Association	E. J. Dann	,, 15, 16
Cooma P. and A. Association	C. J. Walmsley	,, 15, 16
Inverell P. and A. Association	J. McIlveen	,, 15, 16, 17
Armidale and New England P., A., and H. Association (Armidale).	A. McArthur	,, 15, 16, 17, 18
Gloucester A. Society	E. Rye	,, 16, 17
Upper Hunter P. and A. Association (Muswellbrook)	J. M. Campbell	,, 16, 17, 18
Camden A., H., and I Society...	C. A. Thompson...	,, 16, 17, 18
Goulburn A., P., and H. Society	J. J. Roberts	,, 17, 18, 19
Royal Agricultural Society, Royal Agricultural Show	H. M. Somer	,, 22 to 30
Southern New England P. and A. Association (Uralla)	W. C. McCrossin..	,, 22, 23
Gundagai P. and A. Society	A. Elworthy	April 5, 6
Bathurst A., H., and P. Association	A. H. Newsham...	,, 6, 7, 8
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Diseases of the Pig.

[*With Chapters on Ailments, contributed by the Veterinary Officers of the Stock Branch, Department of Agriculture.*]

FORTUNATELY for the pig-breeder there do not occur amongst pigs such a formidable list of diseases, infectious or otherwise, as the breeder of cattle finds himself confronted with, nor is illness in the pig such a serious matter from a monetary point of view as in the case of larger stock. There are, however, two serious infectious diseases—Tuberculosis and Swine Fever,—against which the breeder of pigs must always be on his guard, and many minor ailments which may cause him some loss at different times. The following chapter is intended to assist the settler and farmer in the country districts, who is unable to obtain veterinary assistance, in diagnosing and combating disease amongst his pigs. It will be noted how largely improper feeding and sanitation are responsible for the occurrence and spread of disease, and this should give further weight to the advantage of feeding and housing pigs on scientific and up-to-date lines.

The pig, in health, should have a bright, vigorous appearance, skin smooth and glossy, eyes bright, nostrils clear, breathing easy and regular, appetite good, temperature normal. Any departure from this state indicates ill-health of a more or less serious nature, and notice of these points is necessary to determine from what the pig is suffering and what remedial measures may be necessary, thus—

Temperature should be 103 degrees F., but may rise several degrees.

Breathing—in disease may become hurried and panting, and accompanied by a cough or grunt.

Appearance of eyes and nose.—The membranes should be bright, moist, and clean, but in disease may be inflamed, show a discharge, or become very dry.

Appearance of the skin—is often dull, dry, scurfy, and even discoloured.

The fæces may become very soft, as in diarrhœa, or hard, as in constipation.

The condition of the nervous system, as shown by dulness or excitability.

Administration of Medicine.

It will be found that whatever the ailment, much will depend on improved methods of feeding, and the provision of suitable, clean, and healthy sties and runs; and that the administration of drugs occupies a secondary position;

still cases will occur in which medicine must be given, and this is commonly carried out in one of two methods :—

(*a*) by the mouth (drenching) ; (*b*) by the rectum (enema).

(*a*) Drenching.—To drench a pig, the easiest method is, probably, to get a noose slipped over the jaw, well back towards the angle of the lips ; with this raise the head slightly above the level, open the jaws with a small piece of wood, and with a drenching tin or horn pour the medicine well into the back part of the mouth. If the medicine has no disagreeable taste, it may be given mixed with feed, or dissolved in milk or water as a drink.

When dosing, care must be taken to let the head down on the least sign of choking.

(*b*) Giving an enema.—This is a most useful measure in certain cases, *i.e.*, constipation. A special syringe may be used, or a couple of feet of thin rubber tubing, with a funnel at one end, or a Gamgee Clyster funnel. This is introduced into the rectum of the pig, and the liquid poured in slowly.

Infectious Diseases.

Swine Fever.

The disease known as swine fever is, without doubt, the most rapidly fatal and highly infectious disease to which the pigs of this State are subject, and it is only by the continued enforcement of the present quarantine regulations that it can be kept in check. Like all infectious diseases, it is due to a micro-organism, which usually gains entrance into the body by being swallowed with the food.

The symptoms of the disease are varied, but in any outbreak the most marked feature is the rapidity with which the pigs sicken and die one after the other. In very severe cases, the pig may die within a few hours of its being noticed to be ill. In such a case the symptoms noted are shivering, staggering, a high temperature, difficult breathing, great prostration, and the appearance of red spots on the skin about the ears, breast, and abdomen. The usual form is not so acute, and lasts from a few days to about three weeks. The affected pigs are dull, when moved walk unsteadily, the back is arched, the head carried low, and the tail limp. There is often a discharge from the eyes and nose, the pigs lose flesh, and show all the symptoms of high fever. As the disease progresses diarrhœa sets in, the fæces being blackish or greyish, with an offensive odour ; the animal gradually weakens and dies.

The disease is sometimes shown by pulmonary symptoms, such as a short dry cough and heavy breathing, with a discharge from the nose. It occasionally happens that pigs recover from an acute attack, but remain chronically affected. A pig in this condition generally eats well, but remains poor, has recurrent attacks of diarrhœa, and is dull and unthrifty-looking.

Post-mortem Appearances.

On making a *post-mortem* examination of a pig which has died from swine fever, the lesions will be found to vary with the symptoms. In a case which

has died in a few hours, the only lesions will be small blood spots throughout the organs and muscles and red patches of the skin. In an ordinary typical case the most marked appearances are found in the large intestine where it joins the small intestine; here will be found blackish rounded ulcers of various sizes up to 1 inch in diameter, or the whole surface of the bowel may be covered with a dirty grey membrane.

The lymphatic glands (kernels) are enlarged and blood-stained.

When the lungs are affected they are generally dark and engorged with blood.

Method of Spread.

It has been already stated that the disease is due to a micro-organism, and may be spread in many ways. The commonest method of spread is by the introduction of diseased pigs into a sty, and in this connection pigs suffering from the chronic form of the disease are the most dangerous, since, although they do not show any acute symptoms themselves, they may infect other pigs, which will suffer from the acute form of the disease. The temporary introduction of sows or boars for breeding purposes may also lead to infection of the sty into which they are introduced. In the case of neighbouring piggeries infection may be carried from one to the other on the boots, clothing, &c., of people passing from one place to the other.

Once a sty becomes infected, unless proper precautions are taken, it will remain infective for a considerable time, even though no pigs are kept in it; and healthy pigs introduced later may contract the disease.

Carts, trucks, or crates used in the conveyance of diseased swine may also spread the disease.

Methods of Prevention.

There is no possible cure at present known, and, in any case, prevention is far superior. To prevent the introduction of the disease into a sty, all newly-purchased animals should be carefully examined for signs of ill-health, and care taken that they are from healthy sties. The same applies to the introduction of sows or boars for breeding purposes.

Newly-introduced pigs, or those brought in for stud purposes, should not be allowed into the piggeries, but kept in isolated pens; and, in the case of pigs introduced permanently, they should be kept isolated for about a month. If then healthy, they may be put into the piggeries. Once the disease breaks out in a herd, any sick pig should be killed at once and burnt; all pigs which have been in the same sty should also be slaughtered, and, if in a fit state, used for food. All the yards and sties should be cleaned up, the yards limed, and all woodwork disinfected and whitewashed. The disease may be checked in this way, but a recurrence is always possible; and the only thoroughly safe method of dealing with an outbreak is to slaughter all pigs on the farm as soon as possible, burn all wooden sties and fences, plough up, lime, and crop pig-paddocks, and make a fresh start in another spot.

Tuberculosis in Pigs.

This disease, sometimes known as consumption, is due to a microbe which causes certain alterations in various parts of the body; notably in the lymphatic glands and lung tissue. The microbe can gain entrance to the body through a skin wound, through the air-passages by being breathed in with the air, or by being swallowed in the food.

If pigs are fed on milk from cows suffering from tuberculosis, they will contract the disease; in fact, this is the commonest way of their getting it.

The disease shows very few distinct symptoms; indeed, in some cases, a prime fat pig, apparently quite healthy, is found, on slaughter, to be badly affected with the disease, and therefore quite unfit to be used as food. This is by no means uncommon. When the glands of the throat are diseased, they can sometimes be felt as hard, irregular swellings, having a lumpy feel, and often being movable, to a slight extent, under the skin. In being hard, lumpy, and slightly movable, they differ from an ordinary abscess, which is firm, rounded, and comparatively soft.

Tuberculosis of the lungs should be suspected when there is frequent coughing, the cough being hollow, a discharge from the nose, and poor bodily condition; in addition, the breathing is sometimes irregular, the intake of air being interrupted, and the act of inspiration being in two gasping motions instead of one smooth one; the act of expiration being longer than natural, and blowing. The cough is most marked when the animal is made to move. In boars, the testicles sometimes appear swollen, and sows sometimes show signs of inflammation of the udder.

There is no cure for this disease, and all the efforts of the pig-owner should be directed towards prevention of it, by doing which he will largely reduce the disease and his own losses.

The methods of prevention are:—

Boil all milk given to the pigs, as boiling will destroy the vitality of the microbe causing the disease.

Slaughter and destroy or bury the bodies of all pigs known to be tubercular, as such pigs are a constant source of infection.

Do not give the flesh or offal of old diseased dairy cows, or any other which has been killed on account of old-age or disease, to the pigs for food without thoroughly boiling, and never allow pigs to feed among the dung of cattle, as the disease is often spread in this way.

Do not breed from diseased pigs.

Keep the sties clean, and the more fresh air and sunlight the pigs get the better for them.

It is well known that there is more tuberculosis among pigs than any other farm animals, and the disease is specially prevalent in the dairying districts. It is quite common to find as many as 10 per cent. of a mob of pigs condemned on account of tuberculosis when they are slaughtered for food, and in many

cases the percentage of condemnations has run up to 35 or 40, thereby causing the pig-breeder a heavy loss; but it has been repeatedly remarked that when the breeder has carried out the preventive measures described herein that his pigs have shown a marked improvement in health, the amount of tuberculosis has greatly decreased, as have also the breeder's losses; and all this benefit has been gained at little or no cost to the pig-breeder, but simply by the use of the few simple precautions named.

It cannot be too strongly urged that *prevention* is the only way of checking tuberculosis, and it must always be remembered that a fat pig, which is apparently quite healthy, may have the disease though he shows no outward signs of it.

Non-infectious Diseases.

Diseases of the Respiratory Systems.

Inflammation of the Lungs in Pigs.

This disease is inflammation of the tissue of which the lungs are made, thereby affecting the breathing and, consequently, the health of the animal.

The commonest cause is exposure to cold and wet.

The symptoms are fever, a quick pulse, but at the same time rather weak in the force of the beats, the breathing quick and panting, the eye becomes bloodshot, and later on yellow-tinged, the pig goes off its feed, there is a harsh, rather deep cough, a whitish discharge is coughed up, and there is great thirst. The nose is poked out in a straight line with the throat, and there may be constipation or diarrhœa. The water passed is generally small in quantity and high-coloured.

In four or five days' time the pig generally takes a turn for the better or worse.

Treatment.—Apply a mustard blister to each side of the chest, covering the mustard with a sheet of brown paper, and over that a thin blanket sufficient to keep the pig comfortably warm, but not hot; give a wineglassful of raw linseed oil every morning before feeding, and a dose of 20 grains of carbonate of ammonia in a drench of cold gruel at noon, and the same dose in the evening; these doses to be repeated daily. Dissolve a teaspoonful of nitre in each half-bucketful of drinking-water; feed on green and sloppy foods such as gruel, milk, and so forth, in small quantities; allow plenty of fresh clean drinking water, which has had the chill taken off; keep the pig out of cold draughts, but allow plenty of fresh air, and keep it out of wet. Keep the sty clean. As the pig improves—generally about the fifth day—gradually increase the amount of food, and decrease the amount of carbonate of ammonia, giving the dose once a day, in the evening for choice. The doses of linseed oil can also be reduced if the bowels are acting freely. The mustard blister can be rubbed off with a little sweet oil, but the blanket should be kept on for from two days to a week after the blister has been rubbed off, according to the state of the weather.

Pleurisy in Pigs.

The disease is inflammation of the pleura; that is, the membrane covering the inside of the chest walls, and also covering the lungs.

The commonest cause is a chill, especially if the animal has been overheated; but the disease can also be caused by an injury such as a broken rib.

Symptoms.—Fever, pulse quicker than natural, and the beats stronger and harder than in inflammation of the lungs, shivering fits, dulness, loss of appetite, rapid wasting, nose poked out; water passed is generally high-coloured and scanty in quantity; diarrhœa, or perhaps constipation, may be present; there is pain shown over the region of the chest when the animal is touched there, and the breathing is very hurried and shallow. In the action of breathing the chest appears to be fixed as far as possible, and the breathing to be carried out almost entirely by the muscles of the abdomen. The cough of pleurisy is short, painful, and not as deep or as frequent as in inflammation of the lungs: indeed the pig seems afraid to move his chest at all.

Treatment.—The same treatment as recommended for inflammation of the lungs will answer for pleurisy, with the addition of 20 drops of tincture of belladonna to the linseed oil given in the morning, and to the carbonate of ammonia given at noon and evening. Chlorate of potash can be advantageously substituted for nitre in the drinking-water; dissolve a teaspoonful of the chlorate of potash in each half-bucketful of drinking-water. Carry out blistering in the same way as for inflammation of the lungs, and give the same diet as is recommended for that disease.

Diseases of the Digestive Tract.

Constipation.

By this is meant the retention of the fæces. It is a common symptom in many febrile diseases, and should always be treated. Enemas of soap and warm water will be found very useful, and may be combined with a dose of 2 to 4 oz. of castor oil, or 4 to 8 oz. of linseed oil, according to the size and age of the animal. The animal should then be fed on sloppy food for a time. When badly affected it will be dull, lack appetite, and strain to defecate.

Diarrhœa.

Scouring.—Occurs in many febrile diseases, and from any cause which leads to irritation and inflammation of the intestines, such as the presence of parasites, sudden changes of food, feeding on fermented or mouldy food. Pigs kept in insanitary pig-sties are always liable. In treating, the cause must be ascertained and remedied, while, as a general rule, the feed should be light and wholesome, a dose of castor oil administered to clear away any irritating substance, and medicine given to relieve the irritation, such as tincture of opium 2-4 drams (2-4 teaspoonfuls), chlorodyne 30 drops to 1 teaspoonful; or a mixture of powdered opium 1 part, catechu 5 parts, and powdered chalk 10 parts—a large teaspoonful three times daily.

Inflammation of the Stomach in Pigs.

A disease in which the lining membrane of the stomach is inflamed with a consequent derangement of the system.

Usually caused by eating large quantities of indigestible substances, or drinking brine or other irritating fluids. Arsenic and other irritating poisons will also cause this disease.

Symptoms.—Great restlessness, all food is refused, great thirst, diarrhœa or constipation, vomiting, and pain over the region of the abdomen shown markedly when that part is touched.

Treatment.—If there is constipation give two tablespoonfuls of castor oil in milk every eight hours, and if there is much pain give a teaspoonful of chlorodyne with the oil. A small-sized teaspoon should be used to measure the chlorodyne. Give enemas of warm water and glycerine—1 part of glycerine to 10 parts of water—every eight hours. If there is diarrhœa give the same doses of castor oil, adding 30 drops of laudanum to each dose, and follow it up with 20 grains each of carbonate of bismuth, bicarbonate of soda, and carbonate of magnesia given in warm milk every eight hours. As the bismuth is a heavy drug, the drench must be well shaken up before being given, otherwise the bismuth will sink to the bottom of the drench and the pig will not get it. If possible, wrap flannels wrung out in hot water round the abdomen, but if this is done great care must be taken that the pig does not get a chill when the flannels either cool or are taken off. To avoid chill when the flannels are taken off to be changed, rub the part which has been covered by them with soap liniment or a mixture of vinegar and sweet oil, half and half. Allow plenty of warm milk to the pig, and see that the diet is light and easily digestible for some time after recovery, say two or three weeks, according to the health of the animal.

Torpid Liver in Pigs.

Sometimes called sluggish liver; a condition in which the liver ceases to act properly, and there is an undue accumulation of bile.

Feeding on too rich a diet, especially in hot weather. will often cause this condition; it is also frequently seen in pigs which have been confined for some days in railway trucks, or on board ship, particularly the latter.

Symptoms.—The pig is dull and sleepy, eats in a casual sort of way, evidently not relishing his food, drinks more than usual; the tail, instead of being curled is straight, or nearly so, and limp-looking, and the eyes and gums have a tinge of dirty yellow. There is generally constipation.

It may be remarked here that a pig's tail generally loses its curl and appears straight and limp when the animal is ailing from any cause.

Treatment.—Give half a drachm of calomel at night, and after that has acted give a 1d. packet of Epsom salts dissolved in a tumblerful of warm water, and given warm. The salts should be given about thirty-six hours after the calomel. Reduce the quantity of the food given for a week; that is, give more green food and slops, and less meal for that period.

Poisoning with Brine or Salt.

Pigs are very susceptible to the poisonous effect of brine or salt, and frequent fatalities are reported. Symptoms set in rapidly, the pigs becoming restless, showing signs of pain, vomiting, goes into convulsions, froths at the mouth, and may rush violently about, later they become dazed and paralysed. If noticed early, an emetic should be given, such as 15 grains sulphate of zinc in warm water. Plenty of tepid water should be allowed for drinking, and the pig given large doses of linseed or olive oil, up to half a pint, according to the size. If the pain is excessive, teaspoonful doses of laudanum will allay it.

Poisoning with Phosphorus.

Cases frequently occur in pigs, after poisoning for rabbits has been carried out. The phosphorus causes inflammation of the stomach and intestines, the pig shows signs of pain, has diarrhœa, is very thirsty, may be partially paralysed, or go off into convulsions. If seen early, an emetic should be given as for brine poisoning, followed giving frequent doses of old turpentine in 1 dram doses given in the wheat-meal or oatmeal gruel, or copper sulphate in 30 grain doses. On no account should milk, oil, or eggs be given. Animals should be fed carefully afterwards.

Diseases of the Limbs.

Rheumatism.

This disease is very frequently noted in pigs kept in damp wet sties, and improperly fed. The symptoms are loss of appetite, some fever, lameness, and general loss of condition. The lameness may move from one leg to the other, and swellings occur in the joints, especially in the hock and knees. Preventive measures are of more importance than cure, and consist in providing the pigs with dry clean sties and shelter from winds, while the diet in the case of sick pigs should be light.

Rickets.

More especially a disease of young pigs, and almost entirely due to improper feeding. The bones of the pig are weakened and bend easily, the animals develop symptoms of paralysis, and in long-standing cases are unthrifty and stunted. If, as is generally the case, the disease is endemic in certain piggeries, the feeding should be inquired into and altered in the necessary direction, foods rich in salts being given; the sties should be made warm and dry; and since the weakness which leads to rickets is apt to show a hereditary tendency, new blood should be introduced.

Parasitic Diseases.

External Parasites.

The Hog Louse (*Hæmatopinus suis*).

This is the only common external parasite of pigs, and is usually seen on pigs kept under insanitary conditions, and badly fed. On strong healthy pigs they are not very numerous, and cause but little trouble. It is a small brownish-grey insect, and is generally noted on the thin parts of the skin,

behind the ears and inside the thighs. If in large numbers the pigs suffer from constant irritation, and do not thrive, and the skin is dry and dirty.

Affected pigs should be smeared or sprayed with a 2 per cent. solution of Jeyes' fluid, or other tar disinfectant, or any of the carbolic sheep-dips, and when thoroughly clean put into fresh clean sties. The infected sties should then be thoroughly disinfected and limewashed, and all litter and rubbish round the yards burnt. If pigs are kept in properly-constructed clean sties and fed judiciously they are not likely to suffer from the effects of lice.

Internal Parasites.

The common Round Worm (*Ascaris suillæ*).

Frequently found in the small intestine of pigs. Is a large round white worm growing up to 10–12 inches in length, and unless in large numbers do not seriously affect healthy, strong pigs. In some cases the intestine becomes irritated and inflamed.

The Thorn-headed Worm (*Echinorhynchus gigas*).

A large white worm found in the intestines, usually fixed to the wall by means of its hooked head. This worm, if numerous, may cause severe irritation of the intestines.

The Whip Worm (*Trichocephalus crenatus*).

Usually found in the large intestine, and is of no great importance. It is a small worm about 1–2 inches long, with its anterior end thin and hair-like.

Intestinal worms in large numbers cause unthriftiness, diarrhœa, restlessness, lack of appetite, and in young pigs nervous symptoms. Infestation may be prevented by cleanliness in housing and feeding, and by keeping the pigs in a thriving condition. They should not be fed off dirty floors, but from troughs, and the drinking-water should be as pure as possible. Stagnant pools and marshy spots should be drained off. Good feeding will enable the pigs to resist the parasite.

Pigs affected with worms should be dosed with one of the following:—

Turpentine, 2 to 4 drams—($\frac{1}{2}$–1 tablespoon).

Linseed oil, 2 to 4 ounces well mixed together; or areca nut, 2–3 drams, given in milk.

In any case the drench should be given on an empty stomach.

The Kidney Worm (*Sclerostoma pinguicola*).

A small mottled worm 1 or 2 inches long which is found in the kidneys, ureters, and the kidney fat. Often the affected pig shows no symtoms, but if abscess cavities form in the kidney, and the infestation is very marked, there may be paralysis of the hind-quarters.

Treatment is impossible and prevention is to be obtained by cleanliness of sties and feeding.

The Lung Worm (*Strongylus paradoxus*).

The parasite is found in the air-passages leading to the lungs, and may induce some coughing, but is not of great importance in healthy, well-kept pigs. Prevention is simply a question of cleanliness, treatment being of little use.

Rupture in young Pigs.

Rupture is a condition in which a portion of the bowel escapes from the cavity of the abdomen, and bulges out in some other part; in so doing it lies beneath the skin of the part affected.

The commonest forms are scrotal rupture, when the bowel descends into the pouch which holds the testicles, and umbilical when the bowel bulges out at the navel, being contained by the skin covering that part. An injury to the muscular walls of the abdominal cavity may also cause the bowel to bulge out at the point of injury, of course being covered by the skin.

To deal with a scrotal rupture: throw the pig, lay him on his back, and raise the hind-quarters. Carefully cut through the skin only with a sharp scalpel or castrating knife. The cut should run from inside the thigh backwards towards the tail over the biggest bulge of the rupture. Great care must be taken to avoid cutting the bowel at all. With the tip of the finger carefully separate the skin from the inner sack of membranes containing the bowel. Work the bowel back into the abdominal cavity through the opening through which it has descended, and do this, if possible, without opening the sack of membrane containing the bowel. If the sack must be cut open, great care will be required to avoid wounding the bowel in any way. When the bowel is all back in the cavity of the abdomen, twist the sack which has contained it round and round, so as to close the neck of it, and then tie a piece of catgut or strong white silk thread—surgeon's suture silk is best for the purpose—round the twisted neck of the sack as close to the floor of the abdomen, or, in other words, as high up as possible. The cat-gut, or silk thread, should be first disinfected in a 2 per cent. solution of lysol before using them; the same should be done to the operator's hands and knife, also to the skin of the part operated on. The strictest attention to cleanliness is required for this and all other operations. Sew up the wound in the skin made by the knife, using a surgeon's needle and white surgeon's silk for the purpose. Leave room at the lowest part of the skin wound for any matter that may form to drain away between two stitches, and cover the whole wound with a piece of lint soaked in the lysol solution, and fasten it there to keep out dirt.

To deal with an umbilical rupture: throw the pig and turn it on its back; with a knife such as is used for scrotal rupture, cut through the skin over the protruding bowel from in front to behind. If possible, separate the sack containing the bowel from the outer skin by the point of the finger; if not possible, open the sack, taking care not to wound the bowel. Return the bowel into the cavity of the abdomen, and sew up the opening in the floor of the abdomen with strong surgeon's silk, putting in each stitch about 2 inches on one side of the opening, and bringing it out the same distance on the other side, so that the stitches have plenty to grip, otherwise they will tear out. Stitch up the knife wound made by cutting the skin, leaving space between two of the stitches for any matter that forms to escape. Put a pad of lint soaked in lysol or boracic acid solution, and support everything by a broad

and strong bandage passed under the abdomen and laced along the back, or else sewn. Strong unbleached calico is the best material for this bandage. Of course it must be thoroughly clean, and must be soaked in a disinfecting solution before using.

To deal with a rupture through the side of the abdominal cavity, proceed as for umbilical rupture, except that the pig will be thrown and held on the opposite side to which the rupture exists.

It must always be remembered that the strictest cleanliness must be observed in these and all other operations. The hands of the operator, the skin of the animal, the wound made in operating, the instruments, dressings, and anything used must be well disinfected.

After operating for rupture, the pig should be fed on light, easily-digested food, and not very much of it, for three or four weeks, and the bowels kept open by linseed oil or enemas.

Castration of Boars and young Pigs.

Castration is the removal, by surgical means, of the testicles, thereby rendering the male pig incapable of reproducing his species.

The most scrupulous cleanliness is required in this operation, or serious results may follow.

To castrate young pigs, which should be done when they are about three weeks old, have the pig held by an assistant, who holds the body of the pig between his knees, back downwards, and holds both hind legs in his hands. The pouch is cut through with a scalpel or castrating knife; care being taken not to cut too closely towards the middle line of the pouch, as by doing so the urethra, or pipe which carries the urine from the bladder through the penis, may be cut; and the testicle on that side taken out. The testicle may be twisted off by hand, one hand holding the cord of the testicle firmly while with the other the testicle is twisted round and round until the cord gives way; or the testicle is held in one hand and the cord slowly scraped through with the thumb-nail of the other. The second testicle is then treated in the same way. In the castration of boars, the instruments required, besides a scalpel or castrating knife, are a pair of steel clams with rough edges, and a pair of torsion forceps. The clams should be fitted with a locking ring, to hold them firmly together when clasped on the cord.

Cast the boar on the left side, and secure the right hind leg to the two forelegs. He is held down by assistants, and the operator kneels at the boar's back. Open the pouch over one of the testicles—it is always best to deal with the one lying next the ground first—take out the testicle and pull the cord out as far as possible, taking care not to stretch it too much or the artery of the cord may break, thereby causing serious bleeding; fix the clams on the cord as near the abdomen as possible, and, holding the cord firmly in the clams grip the portion of the cord just above the testicle with the torsion forceps and twist it round slowly and carefully until it snaps. Then slacken the clams slightly without letting go of the portion of the cord held by them,

and observe whether there is any bleeding. If not let the cord return into the abdomen and remove the other testicle in a similar way. Another method is to hold the cord in the clams, and instead of twisting it with torsion forceps, sear it through with a hot iron.

Whatever method is used the same precautions with regard to cleanliness and disinfection must be practised as are required in operating for hernia, viz., disinfection of instruments, dressings, hands of operator, and portion of pig's body being operated on. Care must also be taken that dirt is not allowed to get into the pouch after the operation; prevent this by keeping the sties clean.

If a boar has been castrated, feed him lightly for two days before and five days after the operation, and keep the bowels open with oil or salts.

Spaying of Sows.

By this is meant the surgical removal of the ovaries, by which operation the sow is rendered unable to breed. It is an operation not often carried out, but it may be of interest to know how it is done.

The sow is cast on the right side and the legs secured; she is then held by assistants while the operator kneels at her back in the same way as in castrating a boar. An oblique cut is made with a broad-bladed castrating knife running from a little below—say $\frac{3}{4}$ of an inch—the point of the hip, downwards and forwards through the flank. The cut should be about 3 inches long, and should only divide the skin and muscles, not the membrane lying beneath them. The membrane lining the abdominal cavity is now pierced carefully with the point of the finger, care being taken not to tear the membrane badly. It is best to scrape the membrane with the finger-nail till it is thin, and then puncture it with the finger. The first finger is then passed into the opening, the ovary felt for, caught in the hooked forefinger, drawn out and held in the left hand, while the other ovary is sought for and secured. The ovaries are then twisted off by hand, the wound disinfected and closed by two or three stitches through the skin.

The same cleanliness and care in disinfection must be observed in this operation as in castration. Feed the sow lightly for a few days after the operation and keep the bowels open with linseed oil or Epsom salts.

Handbook on Pigs and Their Management.

A work by Mr. H. W. Potts, Principal, Hawkesbury Agricultural College, dealing with pigs and their management, is now in preparation, and, it is hoped, will be available by the beginning of the new year.

A Note on the Examination of Stallions at Shows.

MAX HENRY, M.R.C.V.S., Government Veterinary Surgeon.

DURING the past year some few Agricultural Societies, foreseeing that legislation on somewhat similar lines to that which has been in force in Victoria for the last few years was likely to be adopted in this State, have taken steps in the direction of compelling stallions exhibited at their shows to pass a veterinary examination before being awarded a prize.

For instance, Corowa A.H. and P. Society have for the past two years submitted the stallions selected as prize-winners for examination, the Hawkesbury A.H. and P. Society did the same, but Cowra Agricultural Society was the first to enforce examination of all stallions for hereditary unsoundness before permitting them to enter the show-ground. Therefore, although the partial examinations at the other shows gave some indication of the extent to which the stallions of this State were affected with hereditary unsoundness, the results obtained at Cowra are the only ones which can be considered of value.

The Society decided that no stallion should be permitted to enter the show-ground without first undergoing examination for hereditary unsoundness. These examinations were mostly carried out on the day before the show, although, unfortunately, there was not sufficient time to admit of all the stallions being so examined; the remainder were examined on the morning of the show.

Only those unsoundnesses which are recognised to be due to hereditary predisposition and faulty conformation were noted, blemishes and unsoundnesses due to breakdown, &c., being disregarded.

The list of unsoundnesses was that adopted for the Government certificate, viz. :—Roaring, curb, thoroughpin and bursal enlargements, ring-bone, bog-spavin, nasal disease, side-bone, bone-spavin, chorea (shivering).

The following table shows the number of horses examined and number of rejections :—

Class.	No. examined.	No. rejected.	Percentage of rejections.
Draughts	13	7	53·8
Light horses	14	2	14·2
Ponies	9	1	11·1
All classes	36	10	27·7

For purposes of comparison the Victorian figures for 1907–8 are given :—

Percentage of rejects—	Draughts	32·30
	Light horses	18·12
	Ponies	16·46
	All classes	24·46

The Toowoomba (Queensland) figures show as under :—

Percentage of rejects all classes ... ... 29·5

Of the draughts at Cowra the majority were rejected for side-bone, in some cases accompanied by ring-bone, thus agreeing with the results obtained in the Victorian examinations, wherein 20 per cent. of the draught stallions were rejected for this reason.

Amongst the light horses, ring-bone, spavin, and curb are likely to cause the larger number of rejections, but no case of curb was observed at the Cowra Show, and, on the whole, light horses were far sounder than the draughts.

The ponies were a still more sound group, the one rejected suffering from ring-bone.

As regards the examination of stallions at shows in general, experience would show that it cannot be recommended, and parades are far more likely to give satisfaction both to stallion owners and the examining officers.

In the first place, examination on the same day as the judging is, if there is any respectable number of stallions submitted, all but impossible as there is not, before judging, sufficient time to allow of a proper examination, and after judging the rejection of stallions which have already been awarded a place by the judges, is apt to cause friction, besides which the publicity of the action calls very marked attention to the horse's unsoundness much to the disgust of the owner.

Examination on the day before the show is, of course, far better, but here again there is a certain amount of publicity, and it is difficult to arrange for all the stallions to be available.

At parades specially arranged there will be ample time for the officer to make his examination, there will be no undue publicity given to the fact that any given horse has been rejected, and no possibility of causing dissatisfaction amongst judges.

As a rule, considerable surprise was exhibited at Cowra by those owners whose horses were rejected, most of them evidently having had previously no idea that their horses were unsound.

Again, there appears much difference of opinion as to what unsoundnesses constitute those generally considered hereditary or of sufficient importance to lead to rejection. As an instance, inquiries were made as to whether the presence of "splints" would cause a horse to be rejected.

A marked instance of the hereditary nature of these unsoundnesses came to light. A draught stallion was rejected for side-bone; later on a stallion and a mare, both by this rejected stallion, were examined—the mare as a matter of curiosity—and both were found to be affected with side-bone.

During the examination it was learnt that several of the stallions submitted had been purchased within the last year or two, and yet, according to the owners, no certificate of soundness had been asked for by them, nor had they had the horses examined by a veterinary surgeon. It would seem to imply some short-sightedness on the part of the buyers, who pay high prices for horses, not to have requested such a certificate, as it must have been evident to all interested in horse-breeding that certification of stallions was bound to become general in a short time.

A Suspected Case of Fungus Poisoning.

MAX HENRY, M.R.C.V.S., Government Veterinary Surgeon.

The following note on this case is published, as it is thought that it may be of interest to stockowners, some of whom may have had similar cases which have not been brought under the notice of the Stock Branch. The cases occurred on Mr. M. H. Blaxland's farm on the Tweed River, and the Department is indebted to Mr. Blaxland for a full account of the symptoms. The first case occurred late in March, when a cow, after being affected for about ten days, died. No *post-mortem* examination was made. Ten days later there was a fall of rain, followed by a great crop of toadstools, and several cows became affected. Treatment with a purgative was successful in most cases, but two resisted treatment until removed to a paddock free from toadstool: they then rapidly recovered. The symptoms were general drowsiness, eye dull, belly tucked up, some evidence of abdominal pain (as shown by moaning and swishing of tails), rapid falling off in condition, slight constipation in most cases, but in one dysentery. These cattle were seen eating the toadstools, so precautions were taken to destroy by trampling them down, when the cattle ceased to eat them. Since that time there have been no further cases. Specimens of the toadstool were submitted to Mr. Maiden, the Government Botanist, and Mr. Cheel, one of his assistants, reported it to be *Lepiota dolichaulus* (Berk and Br.), and stated that there was no previous record of its possessing poisonous properties. However, the evidence obtained against it in the present instance is such as to cause it to be regarded with considerable suspicion, but further information and opportunity to investigate fully are necessary to definitely determine the point.

Preserved Fruit Trade in Great Britain.*

T. A. COGHLAN, Agent-General for New South Wales.

In former years England derived almost all its supplies of dried fruits from Greece, Spain, and France, and prices were then remunerative, but in recent years California and other countries have become large producers, with the result that the market is frequently over-supplied, and prices become unremunerative. There is also now a more uncertain market than there used to be. Dried fruits are after all but substitutes for fresh fruit, and recently there has been a remarkable increase in the import of fresh fruit, chiefly bananas, the consumption of which is now enormous, with the result that the market for dried fruit greatly suffers when bananas and other fresh fruits are plentiful.

Currants.

Greece is the great source of the currant supplies, and the production in that country is so large that some years ago a law was passed to prevent over-supplies and regulate the proportion of the total crop of currants that would be permitted to be exported, and the proportion that must be retained locally. Last year 35 per cent. were so retained. The currants not required or permitted to be exported are chiefly used for making wine or alcohol. Some 60,000 tons of currants, valued at about £1,200,000, are imported annually into Great Britain, and practically the whole supply is obtained from Greece; indeed, it is difficult, if not impossible, to induce the authorities to recognise for customs purposes currants (*raisins de Corinth*) if obtained elsewhere than in Greece. This is an important fact, as currants are dutiable at 2s. per cwt., and fruit from currant vines grown elsewhere, but classed as currants, are subject to a duty of 7s. per cwt. The true currant is grown in the Morea and on the four Ionian Islands, Zante, Kephalonia, Ithaca, and Leucadia, and such is the capricious nature of the luscious and prolific vine which bears the fruit, that transplanted elsewhere, even to other parts of Greece, the currant usually changes its soft and velvety skin to a hard thin one, and develops one or more large pips, loses its exquisite sub-acid flavour, its bloom and texture, and becomes a different fruit altogether. Various attempts have been made to produce this little dark seedless berry by transplanting the vines to Turkey, California, Sicily, and elsewhere, but no matter how carefully the climate and soil be chosen, the vine will have no home but Greece, which has thus a natural monopoly of this, the daintiest of all grapes.

The system of cultivation and curing employed in Greece for the Corinthian grape is peculiar to the country. The vines are planted in square clumps of about thirty or forty vines, and a small earth wall is erected around each

* Report furnished at the instance of the Hon. the Minister of Agriculture.

clump for the purpose of retaining the moisture during the growing period. The earth has to be loosened four or five times during this period by means of a peculiarly shaped hoe, and when the rainfall is deficient the plants are artificially watered.

Currant vines from their delicate character, and from the strain put upon their constitution through the heavy production in proportion to the size of the plant, are much subject to fungoid disease. Not only does the fungus attack the stems, but the fruit itself is frequently affected, and the berries least exposed to light and air rot, and speedily infect the whole bunch, causing great loss. Other diseases attack the leaves, causing them to wither, and thus deprive the fruit of the protection it needs from rain, and from the blazing sun. But science has of late years provided remedies which are generally effective.

The vines are trained in bush form, and the bunches (which differ from ordinary bunches of grapes in being longer and narrower) hang close in to the base of the branches, the outer spray of the branch providing shelter from the scorching rays of the sun, and from cold winds and rain.

In the drying of currants, unlike nearly all other kinds of dried grapes, there is no "dipping" process. In fact, no chemicals whatever are used. In the best vineyards the bunches are laid out on wicker trays in the sun, and when dried, the berries are removed from the stalks, sometimes by machinery and sometimes by hand. The fruit is then graded into sizes by means of machines usually worked by gas engines, and consisting of graded sieves. This work is sometimes done by the farmers themselves, but more often by the dealers in the shipping ports. Another process of drying known as shade drying, has come into vogue in recent years. The fruit is placed in a long, narrow shed, the sides of which are closed in with sliding shutters, like venetian blinds on a large scale. The amount of sun admitted can then be regulated, and the result is indeed a revelation in regard to the colour and texture of the fruit.

The district which produces the best fruit, as a rule, is Vostizza. For some years, however, there had been a noticeable falling-off in the quality of this growth, but recently there has been a distinct improvement, due to the maturing of new vines planted some years ago. The Gulf and Panariti districts also provide fruit of very good quality, and some of the districts which used to be classed under the general term of Provincial, viz., Amalias and Pyrgos, are now producing excellent fruit. The best kind of currants are those which are soft to the touch, regular in size, and free from rubbish. The Greek Government is using every precaution in order to prevent the exportation of improperly selected fruit.

Some years ago, when the French vineyards were devastated by phylloxera, the wine growers bought enormous quantities of the surplus Greek currants, which they obtained at about 12s. per cwt., including a duty of 7s. per cwt. In one year the French people took as many as 70,000 tons of Greek currants. But the French growers replanted their vineyards with resistant vines, and when these became productive they succeeded in obtaining a protective measure

prohibiting the importation of currants for other than domestic purposes. The demand ceased, therefore, and the Greeks in despair, and having then no organisation, shipped their currants to England, where they sold for as little as 6s. per cwt., duty paid.

Raisins.

The raisins imported annually into England average in value just over £1,000,000. Practically all come from Spain and Turkey-in-Asia, although in 1907 £41,368 worth were received from Australia, the quality of which compared very favourably with Valencia raisins. The Australian raisins arrived in June, and, as the market was poorly supplied, they sold for 38s. to 40s. per cwt., duty paid (7s.). Speaking generally, the firms who handle raisins are not hopeful that, as a rule, such fruits would be a commercial success unless they arrived in the months from October to January.

Dessert raisins are grown in many parts of the world, but the Spanish varieties are the only sort with which British buyers have any concern. The fruit is grown around Malaga. The vines are carefully cultivated. When the grapes are sufficiently advanced for drying, the stems are partly severed to prevent the free circulation of the sap, and the grapes are then allowed to remain hanging from the vine, while the sun completes the curing of them. The method of packing calls for some remark. For the English market a good appearance is demanded, and faced tops with small inferior fruit beneath are only too often the result. French buyers obtain a better article. Some of the Denia packers cure their fruit in dessert or muscatel fashion, but the results are far from satisfactory. There is no resemblance in the flavour, and the redness of the fruit is a powerful factor against its popularity.

Muscatels, in good years, should average in price from 60s. to 100s. per cwt., and the Malaga muscatels, though of very fine quality, are not superior to the Australian ones that have been seen on this market in small quantities. Unfortunately, there is at present a glut of muscatels, and fairly good ones can be obtained at 30s. per cwt., duty (7s.) paid.

Of cooking raisins there are many sorts, but it is only in years of shortage that other than Valencias come to Great Britain. In the Spanish province of Valencia the vine is cultivated on a large scale. The vines are grafted and formed into bushes, resembling in appearance large gooseberry bushes (with larger leaves, of course), on which the bunches hang; each year the old wood is pruned away and burnt to ashes to produce a lye, into which to dip the next year's fruit before it is laid out to dry in the sun. This dipping is necessary to remove the "bloom skin" in order to prevent decay during the drying process, and it also softens the skin and makes the fruit much more digestible. The process is primitive in the extreme in the majority of the vineyards. A large copper containing the lye is placed on a bank of earth, under which a fire is lighted, and when the lye is brought to a proper heat, which the operator or husbandman seems to know by instinct, the fruit is dipped in, about 28 lb. at a time, by means of a perforated metal holder attached to a long handle, not unlike a large shrimping net in appearance.

The fruit is afterwards laid on wicker trays and placed on the ground to dry in the sun. The drying takes from seven to eight days, according to climatic conditions, and if rain occurs at this critical period great damage is done. After being thoroughly dried, the fruit is gathered into wicker baskets, and either dealt with in the packers' houses belonging to the grower or sold in its bunched state to dealers in the ports of exportation. In either case the treatment is similar. The work is usually done in a spacious work-shed, with rows of broad counters, at which are seated girls and women with piles of bunches of dried grapes in front of them which they pick. Each bunch of grapes travels through several pairs of hands; the first picker takes off the large berries, the second all the medium berries, and so on, until the seedless berries are left at the end of the bunch, to be dealt with when convenient.

The raisin known as the Elemé is also a very excellent fruit, although rather small. It is grown in many districts of Turkey, and the word "Elemé" simply signifies "hand-picked." There is also the Belvedere, a very excellent brown raisin, grown in the Lipari Islands, off the coast of Italy; this fruit is shipped in the bunched state just as it comes from the drying ground. Neither of these varieties comes to Britain if Spanish raisins are plentiful.

The output of Valencia raisins has considerably decreased of recent years, as the market was over-supplied. It averages about 25,000 tons per annum, and of this quantity as much as 3,000 tons of one season's fruit has remained unsold, owing to unfavourable trade conditions on the principal consuming markets.

Sultanas.

In Smyrna sultanas have been grown too freely, and the Government is now considering the passing of a measure to limit the production as in Greece. The present price varies from 22s. to 35s. per cwt., duty paid. Occasionally good prices are realised, and in 1907 Mildura sultanas sold at 46s. per cwt., duty paid. Arriving in June, they caught a practically bare market, and there was an exceptional demand for them, considering the time of year. A great slump occurred shortly afterwards, and prices fell as low as 22s. per cwt. Most of the sultanas used in England are grown in Turkey, and there are as many districts and varieties of growth of sultanas as of currants. The Carabournia district is situate on a neck of land at the entrance of the Gulf of Smyrna, about 60 miles from the city of that name. This small district produces the finest and largest fruit grown in Turkey—the greatest care being taken by the farmers both in its cultivation and preparation—and the fruit is both regular in size and free from mixture. The small quantity grown, and the high price obtained for this fruit in other countries have prevented its free importation to England for some years. Proceeding inland on one side of the promontory is Chesme, which produces large, coarse, dark fruit, and on the other side Vourla, which produces small clear pale fruit, neither of which growths finds its way to England except in years of great scarcity. The earliest fruit is grown in the Castle district, which is on the coast quite close to the city. This fruit is often cut

when immature to ensure the opening prices, but the practice is bad, as the grape is then hollow and liable to lose colour if kept for any length of time. Sultanas are also grown in many other districts; those from which the bulk of the crops come to the market are Magnesia, Cassaba, and Nimfi, which are all inland from 60 to 100 miles from the shipping port. All these have developed during the last fifteen years. New vines have been planted to meet the great increase in the world's demand, which calls for a supply two or three times greater than twenty years ago, and increased facility of transport has tended to stimulate the production in the more remote districts.

The fruit, when ready, is conveyed by mules and by the railways to the Smyrna bazaars, where the shipping merchants bargain for the various parcels of fruit, much as grain is dealt in on the London Corn Exchange. The bulks are then blended into grades for the various markets, for which reason many parcels are of mixed colours. It does not pay the merchants to ship the fine clear fruit as it comes into their hands, as the cost is high, and they say that the English merchants will not pay the enhanced price for the best fruit necessary to encourage shipments in important quantities.

The gathering and curing of the fruit in Turkey is practically the same as in other countries, except that the bunches, when gathered, are dipped in a lye before drying. The fruit will not otherwise dry in the sun without shrivelling up, and losing some of its plumpness. A little oil is also used as a preservative, and fruit so treated retains its freshness for a long period.

Sultanas are also grown in Greece, and the fruit from that country is much appreciated for its size and quality. Persian fruit is not often imported to England on account of its inferior flavour and the roughness of the native packages.

The remarks made upon the delicate nature of the currant vine apply with equal force to the sultana vine. In Asia Minor in quite recent years, practically the whole of the vines have had to be uprooted and burned, and their place supplied by a stock which has shown itself able to resist disease.

The best fruit is that which is free from any admixture of "blacks," which sometimes mar the appearance of an otherwise good sample. The size of the fruit is not really material, although large-sized fruit commands the higher price from its attractive appearance. Paleness of colour is much sought after, although for flavour and richness a medium coloured fruit is nearly always the best. In recent years some has been sent to England which had been treated with sulphur, a practice which is greatly to be deprecated, as not only is the keeping property of the fruit injured, but its flavour is altered, and much of its value as a food is destroyed. A sultana so treated can be detected by its unnatural brightness.

The hardiest and most successful sultanas are grafted on an American stock. Smyrna sultanas, like Valencia raisins, are cured in a lye, composed of an alkali and the burnt ashes of the vines, and are afterwards dried by the sun in the same manner as the raisins.

Dried Apples.

There appeared to be a good market for dried apples some little time ago, but New York State, Canada, and California all compete to send considerable supplies, and prices are seldom higher than 30s. or 40s. per cwt., according to quality. Dried apples are not subject to any duty. They are imported into the country in the form of rings and dried whole apples, the latter being known commonly as "whole cored apples." The principal country of exportation is America, whence large quantities are shipped every year to England and the Continent. Before the evaporating process, the apples intended for rings are peeled and sliced by machinery, and are then placed in salt water to prevent discoloration, after which they are submitted to sulphur fumes for a short time to fix the colour. The fruit is then placed in trays, which are put into a drying furnace, and when quite dry it is packed in the usual 25 or 50 lb. boxes.

The trade in this article is affected in some degree by the supplies of the fresh fruit in the English market, although it is seldom indeed that there is an entire absence of demand for it, and this is not surprising, as 1 lb. of the evaporated apples is generally supposed to take the place for cooking purposes of at least 5 lb. of the green fruit. The whole cored apples do not, as a rule, sell so freely as the rings, though they are undoubtedly superior. The better article is neglected, as a little more trouble is necessary in the kitchen, although the difference is only that a little extra soaking is required.

Prunes and Dried Plums.

These sell as a rule at very fair prices, and they are now being largely exported from California. The annual consumption in Great Britain is valued at about £250,000. The Californians have devoted special attention to the size of their plums, which look very attractive, but have not nearly so good a flavour nor aroma as the French plum. In years when the crop permits of the latter competing favourably in price with the Californian product, it commands the United Kingdom market for geographical reasons as well as on account of its better quality, but grocers are no longer willing to pay a considerably higher price for the French plum. One pound of the Californian fruit contains frequently thirty to forty plums, and at the present time fruit of this class is about 40s. per cwt., but the average price for Californians usually varies from 28s. to 45s., duty paid. French plums averaging from forty-five to fifty plums to the pound are to-day worth 41s. per cwt., duty paid, and when fifty-four to fifty-nine per lb., 36s. per cwt. Some of the French plums are very small, averaging from ninety to ninety-five to the pound, and of these the present price is 25s. per cwt. The Christmas market is the best for this as for all other dried fruits, but the spring trade is also good, and there is a fair market all the year round. Here also the output has increased enormously during the last few years. Some time ago the industry was practically confined to France, whose output is about 50,000 tons per annum. Bosnia and Servia altogether now produce about 50,000 tons, and California 90,000 tons.

The dried plum section of the world's fruit trade has, perhaps, shown the most marked advance in volume during recent years. It is surprising to learn that as great a quantity of dried plums are consumed as of currants, the total average yield of plums being estimated at about 190,000 tons; but England is a very small consumer, taking only about 7,000 to 8,000 tons per year, although the consumption is increasing.

The usual method of curing French plums is to pluck the fruit when fully ripe, and to dip it into a boiling lye, after which it is generally dried by the heat of the sun, and then packed into boxes. The boxes containing the plums are placed in ovens and subjected to a temperature of about 110° Fahr., which tends to destroy any living organisms which may be present. This aids in preserving the fruit, and is inclined to make it blacker in appearance. A large quantity of the finest French fruit is packed into jars as a dessert fruit, and when packed in this manner it realises a considerably higher price than when packed in wood. It is, however, said by some that this section of the trade is decreasing.

The increase in the British plum trade began at about the time the Californian plum was introduced to the English market, and the increased consumption is mainly of this article. The Californians were the first to pack the plums in a box well adapted for grocery show purposes, in which departure some of the French houses have been wise enough to follow them.

The plum orchards in California range from 5 to 500 acres in extent, and are planted either diagonally or in squares, round which trenches are dug for watering purposes. The trees begin to blossom about the middle of April, and ripen from about the middle of August to September. When fully ripe the fruit is picked, dipped into oil, and laid on trays in the sun to dry. It is afterwards stacked in the trays, and air is allowed to circulate freely about it, which completes the drying process. When completely dry the fruit is subjected by some growers to the action of super-heated steam, which thoroughly cleanses it and destroys all life processes which may have commenced, and it is then packed while hot. Some make a practice of dipping the plums into a colouring solution prior to packing, in order to make them black, in which condition the public in England prefer them, despite the fact that it is anything but a natural colour for a plum, and by demanding the blacker article the buyer often gets the less pure.

The district in California which is generally considered to produce the best quality of fruit is the Santa Clara Valley. Other districts are Sonoma and Saratoga.

The Oregon plum, from the State of Oregon in the United States, is one which is increasing in favour with the British public. It is somewhat similar in flavour to the Californian variety, with the additional advantage of the presence of a very mild acid. It is almost totally black in colour; but, unfortunately, possesses a thick skin. Its large size has undoubtedly helped to gain it favour with the British grocer.

The Bosnian plum is not very popular among the grocers, as it is the worst packed of the three varieties. The fruit usually arrives in unwieldly ½-cwt.

cases, and the system of curing until the last two years has been lacking very considerably in finish. Up to that time it was, from a keeping standpoint, one of the most dangerous of dried fruits for the grocer to handle. The last two years, however, have seen an improvement in the condition of the Bosnian fruit, while this season's importations left very little to be desired from the standpoint of quality and condition, and, given a more easily handled and attractive package, the Bosnian fruit would soon be able to secure a much larger share of the English trade at very little disadvantage in price.

Apricots.

For apricots, the trade is fairly promising, and the average price may be taken at from 42s. to 60s. per cwt., although, occasionally, it rises to 75s. per cwt., and last year, which was exceptional, it was even higher still. These prices include a duty of 7s. per cwt. There is a fair demand for apricots all the year round.

Evaporated apricots come, principally, from California. The fruit is usually stoned immediately after being picked, and is then sulphurised, after which it is dried by the sun, and then dipped into a preservative solution [?]. The fruit thus prepared is what is generally known by the trade as evaporated apricots, though that term is equally applicable to what is usually described as a sun-dried apricot—that is, fruit not treated with the sulphur. The evaporated apricot is generally regarded with more favour than the sun-dried variety, as the latter requires an additional twenty-four hours' soaking. There is, however, no doubt that the sun-dried variety is the purer article of the two; and it is to be hoped that Australians will always continue to ship their fruit in this state, and that the trade generally will soon recognise this fact, and push the better article. Both sun-dried and evaporated apricots, when obtainable at ordinary prices, make a very cheap jam if they are soaked in water until they are quite soft, and then treated in an exactly similar manner to that adopted when fresh fruit is used. Apricots are shipped under different general descriptions, viz. :—"Moorpark," "Northern," and "Southern," each of which is graded into several different qualities commonly known as "extra fancy," "fancy," "extra choice," and "choice." The Moorpark fruit, which commands the highest prices, is the boldest fruit and choicest in quality, the colour usually being a very rich golden red. The Northern apricot is the next best in quality, and is better known as the Royal apricot. The bulk of the shipments to this country are of this grade. The Southern apricot is the most inferior of the three, and is shipped more to the Continent than to this country. Australian apricots are looked upon very favourably by the trade, and are quite equal to, if not better, than the best Californians.

Nectarines.

Recently the Californians sent over a few tons of dried nectarines, but these have not sold readily in the English market.

Peaches.

For dried peaches the trade is fairly promising for the Australian grower. The Australian dried peaches are liked much better than the Californian fruit, as they have not the rather offensive smell which the latter have before they are cooked. There is no duty, and the price varies from 35s. to 42s. per cwt.

Figs.

Figs are imported in large quantities, and the price varies entirely according to the manner in which they are prepared. Good Smyrna figs in bags are now worth 22s. per cwt., and in boxes 33s. It is very doubtful if they could be exported at a profit from Australia. The average import of figs into Great Britain is valued at about £240,000 annually, the duty being 7s. per cwt., and practically the whole supply comes from Turkey-in-Asia.

The fruit is allowed to remain on the trees until just ripe enough to fall when the tree is shaken. The fruit is then packed into horsehair bags for protection and conveyed by railway into the Smyrna bazaars, where the various deliveries are inspected and bargained for by the fig packers. The business of packing into boxes for the various markets is a very extensive one, and develops year by year. A first-class packing hand earns very good wages, and only the best packers can afford to employ such labour. The difference between careful and careless packing is very easily told. A badly packed parcel is irregular from box to box, and the tough figs have not been eliminated.

Almonds.

Shelled almonds (duty free) are imported into Great Britain in large quantities, chiefly for use in sweet-making. The demand in Germany is even greater. Britain imports some £600,000 worth annually, chiefly from Spain and Portugal. The Jordan variety, which comes from Spain, is the most valuable, fetching from £7 to £15 per cwt., but the annual import of these only amounts to about 10,000 boxes of 28 lb. each.

Valencia almonds from Spain are next in price, fetching 105s. per cwt. in Great Britain—the c.i.f. price being 95s. About 20,000 boxes of these are imported annually. This variety is flatter than the Jordan almond. But the great bulk of the trade is in bagged almonds, which come from Morocco, Italy, and France, as well as from the countries previously mentioned. Morocco almonds usually fetch about 45s. per cwt. (they are dear at present, and their price is 75s.), and almonds of good quality range from 70s. to 100s. per cwt.

Dates.

During the last five years dates to the value of £270,000 have been imported annually into Great Britain. They are sent from various parts of the globe, including Egypt, Arabia, Tunis, and Tafilat, but the chief source of supply is Persia, where the date-palm flourishes and is cultivated on a large scale. The fruit is not allowed to run wild, as is sometimes supposed. The plantations are closely guarded night and day when the fruit is maturing, by natives and their families, who derive their subsistence solely from this work.

A strong feature of interest in connection with the date harvest is the fact that directly the fruit, which hangs in huge festoons from the palms, is ripe, a drying wind appears which evaporates the moisture of the fruit and puts it in a condition to keep good for years. A failure of this wind at the psychological moment would mean starvation for thousands, but such a failure, I think, has never been known.

Bussorah dates are so named from the port of that name. They are grown on the banks of streams flowing into the Persian Gulf, whose waters are derived from the Euphrates and Tigris. The quantity of dates annually exported from the district of Bussorah amounts to some 200,000 tons. This fruit forms the staple article of food of hundreds of thousands of the inhabitants of that part of the globe, whose general health and physique testify to its nutritive value. Dates contain nearly 60 per cent. of pure sugar. Bussora dates are now quoted at 10s. 6d. per cwt., but the usual price may be taken at 8s. to 9s.

The Possibilities of Australian Export Trade.

The London representatives of the Australian Dried Fruit Association are very pessimistic as to the possibility of Australia exporting dried fruits at a profit. The Association was formed in order to regulate prices and to procure a better market for dried fruits produced in Australia, and should New South Wales growers produce dried fruits to any extent, the Association hope they will join their body; but it is, of course, a matter of opinion whether it would be desirable to do so.

Australia imports large supplies of dried fruits, and offers, therefore, a home market for considerable quantities of locally-produced fruits. The most promising fruits for export to Great Britain are almonds, plums, apricots, apples, peaches, and raisins, and if the quality of these be equal to those received from elsewhere, they will find a ready sale.

Crystallised Fruits.

As I thought you would be glad to have information regarding the demand for crystallised fruits also, I caused inquiries to extend to this industry.

The trade in crystallised and glace fruits in Great Britain is comparatively of recent growth, and has only attained important dimensions during the last ten years. It is confined strictly to the months immediately preceding Christmas, and any stock which cannot be disposed of before the 25th December in each year becomes practically unsaleable.

France retains the practical monopoly of the supply, which may be valued in round figures at about £60,000 annually. The fruits mainly used are apricots, pears, plums, greengages, chinois, and cherries. They are packed usually in planed white wooden boxes (shoulder lids), containing nominally 7 lb. of fruits. Three grades are packed, viz.: Extra, 1st Choice, and No. 2. The fruit is also packed in boxes of 2, 4, and 7 lb., containing alternate rows of apricots, pears, plums, and greengages, and the boxes are placed in crates containing thirty 7 lb. boxes, fifty 4 lb. boxes, and one hundred 2 lb. boxes.

The same assortments of fruits are also sold in considerable quantities under the name of Metz fruits, when they are packed in fancy cardboard cartons, containing $\frac{1}{4}$, $\frac{1}{2}$, or 1 lb. each. Sales are generally made about July and August in advance of shipments, which begin to reach England during October and November, in time for distribution before Christmas.

Prices were unusually low in 1908, as America did not take her usual supply, which was consequently thrown on the market, after the trade had already supplied itself. The average prices (duty paid, ex wharf, London), were about as follows :—

Apricots	1s. 1d. to 1s. 3d. per lb.
Greengages and pears	11d. to 1s. ,,
Chinois	1s. 2d. in 7 lb. boxes.

Assorted Fruits.

		Extra.	1st Choice.	No. 2.
Bulk ...	... 7 lb. boxes...	11$\frac{1}{4}$d.	10$\frac{1}{2}$d.	9$\frac{3}{4}$d. per lb.
Nominal weight. Gross for net.	4 lb. ,, ...	42s.	38s.	36s. per doz.
	2 lb. ,, ...	19s.	17s. 6d.	16s. ,,
	1 lb. ,, ...	9s. 6d. per dozen.		
	$\frac{1}{2}$ lb. ,, ...	5s. ,, ,,		
	$\frac{1}{4}$ lb. ,, ...	3s. ,, ,,		

Duties on—	Apricots, greengages, and plums ...	$\frac{3}{4}$d. per lb.
,,	Chinois and pears	$\frac{1}{4}$d ,,
,,	Metz Fruits 1 lb. cartons	3d. per doz.
,,	,, ,, $\frac{1}{2}$ lb. ,, ...	4d. ,,
,,	,, ,, $\frac{1}{4}$ lb. ,, ...	2$\frac{1}{4}$d. ,,

Glace cherries make a trade of some importance, which proceeds all the year round, and amounts to about 800 tons annually, valued at about £60,000. The production is almost entirely French, but Italy and Germany now send small supplies. Cherries in wet brine are also brought to London in barrels, and prepared there for sale. Two qualities are made in France—No. 1 and No. 2 Bigarreaux, and the difference in price is about 1d. per lb.

The cherries are packed in boxes containing 5 kilogrammes (11 lb. English), and also in 10 kilo. boxes, but chiefly in the former. The 5 kilo. boxes are planed white wood (shoulder lids), and are lined with paper. They are packed in crates containing thirty 5-kilo. boxes and 15 10-kilo boxes, and are sold at the net weight of the cherries, allowance being made for the paper. Glace cherries are used chiefly by confectioners and cake-makers for ornamenting and filling, but the grocers also buy fairly largely for Christmas for domestic use.

A Griotte cherry is also preserved, but the sale is restricted, as the fruit does not keep well, and turns dark after being in syrup for any length of time. The cherries are packed, faced and unfaced, in 5-kilo boxes, one farthing ($\frac{1}{4}$d.) per lb. being charged extra for facing, which gives them a brighter and better appearance.

Crystallised cherries sell on a smaller scale, and fetch about 2d. and 3d. per lb. more than the glace cherries. Prices have been low this season

owing to over-production—No. 1 Bigarreaux selling at 6½d. to 7d., No. 2 5½d. to 6d. per lb. (duty paid, ex wharf, London), duty one-eighth (⅛) of a penny per lb. As a rule, prices are about 1d. per lb. more than these, and in years of scarcity as much as 9d. and 10d. per lb. has been paid readily for the best qualities.

In France, which is by far the chief source of supply, the fruit is purchased in the open market from day to day, and prices are averaged by the buyers. It is bought in competition with fresh-fruit buyers over a wide area. The fresh cherries are placed in hogsheads in a preparation of sulphur and water, where they are kept until required for packing. They are then taken out and boiled in coppers in about ten different syrups and are kept in earthenware tureens until required for draining; before packing into boxes they are drained for about a week on sieves.

The other fruits, such as apricots, pears, greengages, &c., are subjected to practically the same treatment, except that they are not sulphured, and are crystallised or glaced at once. Sometimes they are left in the syrup until required for packing. Only pure fruit and sugar are used, but the tops of the glace fruits are sometimes varnished over for the sake of appearance, but this practice is not to be recommended.

One of the peculiarities about this trade is that it is confined, as I have already mentioned, almost entirely to France, the bulk of the work being performed by women who have the whole of the business at their finger-tips, the men merely doing the laborious part of the work. The manufacture of crystallised fruit is confined practically to one district—Carcassone—and the number of people, including children, who are employed in connection with it does not exceed from 500 to 1,000, most of whom are related.

The manufacture of crystallised fruit was tried in England only quite recently with absolutely no success, although the firm that tried it went to the expense of importing an expert from Carcassone. When I asked the the reason of its failure, I was informed that it was really due to having no combination of workers who understood the business. Personally, I think it was a matter of price, as labour is much cheaper in France than in England. Italy and Germany are also beginning to take up this manufacture. Italy appears to be making the most headway. I have been unable to ascertain the reason, unless it is that labour is exceedingly cheap there.

The general opinion is that New South Wales or Australia would be unable to make a success of the industry from a commercial point of view, as their seasons are directly the opposite of those on this side of the globe, and they would, therefore, be compelled to keep the product too long for a ready market, as the whole of the fruit in Europe is picked, manufactured, packed, and sold within six months.

The opinion is expressed, also, that if the fruit is kept in syrup longer than six weeks it begins to deteriorate. I suggested that we could cure our fruit in the same way as the French, and place it on the London market long before them, but I was met with the reply that we should get only very low prices.

In regard, therefore, to dried, desiccated, and candied fruits, the market possibilities cannot be considered as particularly favourable. For fresh fruits, however, the market in England is practically unlimited. This is specially the case with all the softer classes of fruit, such as peaches, plums, nectarines, apricots, pears, persimmons, &c., which grow so abundantly in New South Wales, and which could be cultivated with great success in the large area commanded by the Barren Jack reservoir.

South Africa is the most remote country from which soft fruits are at present obtained; but in order to get fruit over in marketable condition it is picked green, and a good deal of it, when placed on the market, lacks the characteristic flavour of fruit ripened in the sunshine. It has been suggested to me that these fruits might be carried from Sydney to London *in vacuo*, and might be delivered in the same condition as when placed in the chamber in Sydney. A good deal has been written upon this subject, and from the assertions of writers it would seem that the chief drawback was the inability to make a high vacuum at a cheap rate. I found that an eminent firm of caterers interested in an abundant supply of fresh fruits were about to experiment with a high-vacuum process for the purpose of seeing whether it might be used commercially with success, and I asked permission to watch the experiments and take part in them with a view to investigating the suitability of the process to the Australian trade. The experiments undertaken were continued for a considerable time, and covered a good deal of ground, but in this report I need only refer to them so far as they concern fresh fruit. From observation of the experiments extending over two months I conclude that a high vacuum may be produced cheaply, but it is extremely difficult to maintain the vacuum in ordinary chambers, and that steel cylinders, though excellently made, did not enable the vacuum to be maintained, which during the course of the day would fall from 29·7 to 28 inches. It was found that fruit kept in a vacuum chamber of only 28 inches was apt to decay, and those who watched the experiments for me considered that fruit could only be kept in good condition when the vacuum was perfect, or almost so.

Although the making of the vacuum in the first instance was not costly, the maintaining of it during the voyage from Sydney to London would be an expensive process, and I am forced to the conclusion that the business could not be made commercially successful.

There can be no question as to the ability of the United Kingdom to take fresh fruit in great abundance. The population here has had little chance of consuming fruit, as the price is so extraordinarily high as to make fruit the luxury of the rich, but even under present conditions there is an enormous sale for all classes of fruits.

On some Plants which cause Inflammation or Irritation of the Skin.

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

PART II.

WE now deal with a number of miscellaneous plants and plant-substances which induce irritation of the skin. Literature concerning such plants, except in regard to *Rhus* (see my former paper in the *Gazette* for February, p. 111) and *Primula*, is exceedingly scarce or wanting. There is no doubt that the subject requires thorough ventilation, and then the attention of medical men will be drawn to it, and methods of prevention and palliation devised.

Rutaceæ.

Phebalium argenteum, Sm.—This has been called the "Western Australian Blister Plant," and Dr. Alex. Morrison* has shown that it blisters the human skin if handled. It has also been suspected of poisoning stock, though no details of this are available. It probably owes its acridity to an essential oil, as do so many plants of the family to which it belongs.

Meliaceæ.

Dysoxylon Richii, C. DC. (*D. alliaceum*, Seem.), native name Maotamea, is found in several Polynesian islands. Dr. Funk, of Apia, Samoa, informs me that the sap or sawdust causes a kind of eczema on the hands, also eye inflammation, and a burning feeling in the throat.

Dysoxylon Muelleri, Benth. ("Red Bean").—This well-known furniture wood of New South Wales has been accused as follows:—Some cabinet-makers report that after working at it for "four or five days they begin to suffer from a virulent form of influenza, accompanied by violent fits of vomiting and bleeding at the nose, while if they cut themselves in handling the timber, blood poisoning almost inevitably ensues. Remarkably enough, the more seasoned the wood is, the worse it becomes."

It appears to me that the language of exaggeration has been here employed. So far as I can glean, the wood, and particularly the sawdust, is exceedingly irritating to some people, and it has indeed induced severe eczema, and also irritation of the mucous membrane.

Leguminosæ.

Castanospermum australe, A. Cunn. ("The Black Bean").—This well-known furniture timber of New South Wales and Queensland has, like the Red Bean (*Dysoxylon Muelleri*), been accused of injuriously affecting the health of workmen.

**Chemist and Druggist*, 8th July, 1899, p. 63.

Myrtaceæ.

Eucalyptus maculata, Hook. (the "Spotted Gum").—In parts of Queensland, timber-getters and sawyers who handle Spotted Gum are sometimes affected with a rash, called "Spotted Gum rash." I asked a number of timber experts: "Do you know any district in which this skin complaint prevails, and can you furnish any particulars in regard to it?"

Most questionees never heard of it, but Mr. A. Vogele, Mt. Douglas, Paterson, N.S.W., reports:—"Spotted Gum rash prevails here. Some are affected more than others. One of my neighbours, who worked with me in the bush for years, felt its influence if only working beside a Spotted Gum; to work one up was out of the question. If persisting in doing so he would itch, and afterwards break out in pimples. Every occasion he got affected more; at length he had to sell his selection on account of it."

Eucalyptus hemiphloia, F.v.M. ("White or Grey Gum").—I have heard on one occasion of this timber causing a rash in a man, or at least of a rash being attributed to this timber.

Onagrariaceæ.

Œnothera biennis, L. (the "Evening Primrose").—Dr. E. G. Seligmann, of London, wrote to me that the above plant produces eczema in human beings.

Araliaceæ.

Hedera Helix, L. (the common "Ivy").—I have abundantly shown in my previous paper that the Poison Ivy (*Rhus*) is worthy of its name. I enclose a statement from Mr. H. Selkirk, well known in horticultural circles in Sydney, showing that the common wall Ivy may irritate the skins of some people:—

> I mentioned to you that I had heard of the ordinary ivy causing trouble, and I have verified my statement. A Mr. ——, of Mosman, pruned his ivy last year, and for weeks afterwards was in the doctor's hands with his hands and arms in a very bad state. One of my own brothers suffered in a mild way after similar work, while I myself had a somewhat similar experience.

Certainly common Ivy does not affect many people, but I am collecting evidence in regard to all skin-irritant plants for the first time.

Compositæ.

Cassinia aculeata, R.Br.—This shrub is sometimes known as "Dogwood," and Dr. A. W. Finch Noyes, F.R.C.S., surgeon in charge of the Skin Department of the Melbourne and Alfred Hospitals, read a paper* before the Medical Society of Victoria on this plant, which is accredited as the cause of eczema.

Details are given of seven cases, several of which suffered only when the Dogwood was in flower, and the patient had come in contact with it by brushing through the scrub, and other ways. The symptoms indicate that minute particles of some kind, such as pollen from the flowers, or irritating

**Chemist and Druggist of Australasia,* August, 1899, p. 240.

particles from the bark, get between the clothing and the skin, and where there are loose folds of clothing in contact with parts of the skin inflammation is often produced. The eruption is often scaly, with great irritation, and a feeling described, in some cases, as if fire were running through the part. In one case, a resident of Gippsland was driven from the district twelve years ago, and six months ago returned. He had a second attack of the eruption, which was relieved when he left the district. He determined to live down his susceptibility, and went back, but returned a few weeks ago, with an eruption similar to that in previous attacks.

Mr. C. Collyer, of Brunswick, Victoria, writes to me under date 12th December, 1904:—

> Referring to your notes in the *Argus* of 10th instant, mention is made to effect of *Cassinia aculeata* on the skin of human beings. Permit me, as a resident at one time and recently of Walhalla, and as a sufferer, too, from what is locally known as "mountain itch" in that place, to point out that the so-called itch is due to animalculæ from diseased or blighted specimens. The blight referred to blackens the whole shrub. I have in my own experience observed that not only myself but others have been affected similarly on passing near or through the blighted specimens, especially in mountainous Gippsland. Further, I have not seen the peculiar blackness on the lower country nor in the Otway district, nor even in stretches of Southern Gippsland, and where what we call cotton bush (dogwood) also abounds.
>
> Last Christmas-time my eldest son and I tried to get through a dense undergrowth in the Otway Forest, mostly of young *Cassinia*, and though in bloom and passing from bloom to seed, we suffered no inconvenience whatever, whereas I could not go within twenty paces of certain places in the Walhalla district without covering my face entirely with a veil—winter or summer. Flowering-time was no worse than any other part of the year if not damp.
>
> Our only remedy was to go to the flat country, as we called the lower ranges. Washing the face or parts affected produced intense burning, and in the eyes an extremely acute pain.

Pyrethrum (*Chrysanthemum*) *Parthenium,* Sm. ("Feather Few").—The late Rev. H. E. Thomson, of Murrumburrah, N.S.W., could never tolerate this plant, which always produced an eczematic swelling on his face. He was fond of gardening, and proximity to this plant always distressed him. He tried to resist the effects, and finally had to remove all such plants from his garden.

Erigeron linifolius, DC.—Dr. Doyle, of Newcastle, sent me specimens of *Erigeron linifolius* ("Cobblers' Pegs"), which had induced inflammation of the skin in a patient of his at Port Stephens.

Helenium autumnale, L. ("Sneezewood" of the United States).—V. K. Chestnut, in a Bulletin entitled "Thirty Poisonous Plants" (U.S. Department of Agriculture), says:—

> The whole plant, especially the flower, is bitter and more or less acrid and pungent. The powdered plant causes violent sneezing when inhaled, and it is, therefore, used in medicine to produce that effect. Sheep, cattle, and horses that are unfamiliar with the plant are often poisoned by it when driven to localities where it abounds. As a rule, these animals avoid it; but it is claimed that they sometimes develop a taste for it, and are killed by eating it in large quantity. The poison exists principally in the flowers. The young plants appear to be only very slightly dangerous; in the mature ones the amount of poison varies greatly even in the same field.

Centipeda.—In New South Wales we have two common Sneezewoods, natives of low-lying land, *Centipeda* (*Myriogyne*) *orbicularis* and *C. minuta,*

which, when dry, also cause irritation of the mucous membrane. They are recorded here for completeness' sake. I have not heard of them producing serious illness.

Primulaceæ.

Primula obconica, Hance.—Dr. S. A. L. Swan records* two cases which came under his notice in Ireland in which the symptoms produced by handling this plant resembled those of acute eczema or erysipelas. The effect of this plant on human beings is now well recognised by gardeners, and references to it in horticultural literature are frequent; for example, *Gardeners' Chronicle,* 9th April, 1892, p. 469. At the same time time some people are not affected by it. This is the case, however, with most plants which are irritant. It is alleged that Dr. Riehl, of Vienna, has ascertained that the irritation is caused by the tiny hairs on the leaves and stalks.—*Gardeners' Chronicle,* 4th May, 1895, p. 558.

Primula sinensis, Sabine.—Eczema of the hands and face has been caused through handling this primrose. It appears to be less virulent than *P. obconica.*—*Gardeners' Chronicle,* 12th January, 1895, p. 47; 26th January, 1895, p. 116.

After the above references were given in my paper in the "Trans. Therapeutic Society," a special work was published, viz., "Hautreizende Primeln. Untersuchungen über Entstehung, Eigenschaften und Wirkungen des Primelhautgiftes," von Prof. Dr. A. Nestler (Berlin, 1904).

The author writes, p. 7, "From experiments I made it is the secretion of the glandular hairs which causes the irritation of the skin." Further, p. 6 and 7, "At present we know fourteen forms of *P. obconica;* all have the same skin-irritating properties."

Primula obconica, Hance, and *Primula sinensis*, Lindl., are the only primulas whose skin-irritating properties are fully discussed in this work (Einleitung, Introduction p. 5).

The skin-irritating properties of *Primula sinensis* are not so strong as those of *P. obconica,* and the author has shown by experiments that *Primula Sieboldii,* Morran, and *Primula cortusoides,* L., have also skin-irritating properties caused by the secretion of the glandular hairs (p. 6).

Primula obconica, Hance, has the strongest irritating effect on the skin.

P. sinensis, Lindl., and *P. Sieboldii,* Morran, have an irritating effect on skin, but less strong than in *P. obconica.*

P. cortusoides, L., causes irritation of the skin in a very mild form.

The following species of *Primula* have no trace of an irritating action on the skin :—*P. officinalis*, L.; *P. megaræfolia*, Bour.; *P. floribunda*, Wall.; *P. auricula*, L.; *P. capitata*, Hook.; *P. farinosa*, L.; *P. japonica*, Grey; *P. hirsuta*, All.; *P. Clusiana*, Tausch.; *P. minima*, L.; *P. rosea*, Royle.

**Lancet*, 25th April, 1891, p. 960; *Pharmaceutical Journal*, 2nd May, 1891, p. 981.

The irritating matter is, in all species of *Primula* discussed, the secretion from the glandular hairs.

There is also an article: "The poisonous properties of *Primula obconica* and *P. sinensis*" in *Gardeners' Chronicle,* 6th October, 1906, p. 246.

There is a bibliography of the subject at p. 45. This work contains four illustrations, one of which, showing the effects of *Primula obconica* on the hands and forearm of a human being, I reproduce.

A Plant of *Primula obconica.*
Grown in the Botanic Gardens, Sydney.

The effects of *P. obconica.*

I also show a photograph of a rather weak plant of *P. obconica* grown in the Botanic Gardens.

See also Daffodil-poisoning below, p. 1078.

Euphorbiaceæ.

Excœcaria agollocha, L.; *Excœcaria parvifolia*, Muell., Arg.—These two yield an acrid juice which is more or less volatile, and which, if it gets into the eyes, will produce temporary loss of sight and other local irritation.

Urticaceæ.

To the number of plants which cause eruptions on delicate skins, Anstruther Davidson adds *Solanum xantii*, a common plant in California, and also the common cultivated fig. In the latter case the cause of the trouble is the minute hairs on the leaf. The fruit, being free from these, does not give rise to the eruption. The dermatitis is observed chiefly among children engaged in gathering figs; but adults with delicate skins are affected. The author states that the presence of these irritant hairs hardly accords with the accepted statement that the fig leaf formed the primitive garment of man.—(*Therap. Gaz.*, 22, 86, quoted in *Pharm. Journ.*, 4th series, viii, 335, 15/4/99.)

The irritation caused by the skin of the common edible fig is so well-known that people usually peel it before eating it; if they omit to do so, they are reminded by the irritation of the mouth.

Irritation of the hands from this cause is less common. A lady in North Sydney can never gather her crop of figs, much less handle them during the making of pickled figs, fig-jam, &c.

Coniferæ.

Thuja Douglasii, Carr.—A curious case of a woman being poisoned by handling the branches and leaves of this tree while gardening is recorded by Neudorffer in the "Centralb. f. Innere Medicin."* "The symptoms were spasmodic convulsions, dyspnœa, and coma. Other persons appear to have been more or less affected who were working at the same employment. It appears probable, therefore, that the tree, which is cultivated for ornamental purposes, contains some poisonous ingredient to which some persons are more susceptible than others."

I admit this plant to the present list with doubt. But attention should be widely drawn to such a well-known tree, in order that we may ascertain what are the real facts of the danger of handling it.

Amaryllidaceæ.

Daffodil Poisoning.

In the *Gardeners' Chronicle* of 11th March, 1905, p. 158, there is a note on daffodil poisoning, as follows:—

Mr. J. Lowe wrote, stating that the gatherers of daffodils often suffered from sore hands, and requesting some information as to a remedy. Mr. J. Walker wrote, stating that usually only those who had chapped hands, or who failed to wash their hands after picking the flowers, suffered from the trouble. The committee were of opinion that the crystals of calcium oxalate (raphides), which are frequently in abundance in this and similar plants, were the cause of the trouble; and it was suggested that the workers should thoroughly grease their hands with tallow before picking the flowers, or should wear gloves.

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* *Nouv. Rem.*, 1903, 65. Quoted in *Pharmaceutical Journal*, 21st March, 1903, p. 422.

This report called for a reply in the issue of the journal of the 18th idem, from which the following extracts are taken :—

Though I have been closely associated with the early forcing of daffodils for nearly twenty years, handling as many as 300,000 in this way in a season, and am also familiar with the produce of many acres from the open ground at a later date, necessitating considerable assistance, I have only known of two instances where any irritation has been caused.

It appears that the irritation affects the flower-gatherers rather than those who bunch the flowers, the hands of the former coming into direct contact with the exuding juices of the plant. In the first instance the irritation and inflammation were so severe that I was compelled to take the man from the work. He was the only one affected out of a dozen or more. I am not of the same opinion as Mr. J. Walker, that chapped hands or dirty hands have much to do with the matter, but rather that some persons naturally are more susceptible to these attacks. Of course, if a cut or scar exists on the hands, and the juices come into contact with it, there is every reason for the attack. In the instance referred to there were no such scars existing, and the bare arms—for my men usually gather with the sleeves uprolled—were as badly affected as any part of the hand. I have never tried the effect of putting grease on the hands, and, from the way much gathering polishes the finger-tips and hands, should doubt its efficacy. If gloves are at all practicable, the finger-tips should be removed. By reason of the quickly polishing and drying effect the gathering of daffodil flowers has upon my own fingers and hands generally, I frequently hold them in the water-tank, and give them a good rubbing together through the water.

It is also interesting to note that while I was probably one of the earliest and worst sufferers in England from the irritation caused by *Primula obconica*, I have never experienced any discomfort from the daffodils. Equally interesting is the fact that the person who, years ago, suffered much from the daffodils could handle the *Primula* with impunity. It is the same to-day, and the worker who suffers from the daffodil irritation is not in the least affected by the *Primula*. Hence I regard the susceptible nature of the skin to be a more or less predisposing cause when cuts or scars are absent.

A correspondent of the *Gardeners' Chronicle,* 11th March, 1905, p. 156, stated that in taking down two large plants of the American Aloe (*Agave americana*) which had just flowered on St. Michael's Mount, Cornwall, the sap getting on the skin caused intense irritation. The editor attributed the irritation to raphides (minute crystals) as in the case of bulbs. I should be glad if readers would say whether they have a similar experience in dealing with so common a plant.

A letter, entitled "Bulb Sorters' Finger Nails" will be found in the English journal "The Garden," of 2nd September, 1905, p. 139, in which the statements are made, in referring to the above, that there is no cure for bulb sorters' disease except leaving the bulbs alone. Gardening gloves are no use, as they do not prevent some dust getting under the nails.

"The Garden," of 3rd February, 1906, p. 67, has the note:—

We force large quantities of daffodils for cut flowers. The men working in this crop very frequently get their hands poisoned by the juice which flows from the base of the flower-stalk when broken or cut. To aid us in arriving at a suitable remedy for this, we should like to know what poison it is which is present in the plants. Being ourselves quite ignorant on the point, we inquired of one of our largest daffodil growers, who told us:—"It is an old complaint, as I have observed it all the time I have grown daffodils. Nearly all the men and women suffer more or less with bad hands at bunching-time. It is caused, I think, by their having chapped hands, on which the juice of the daffodil acts as an irritant. But if there is no broken skin, and the hands are well washed after bunching the flowers, there is little, if any,

poisoning." Having obtained so much information, we at once examined the matter for ourselves, and we find that the "poisoning" is purely mechanical. It is caused by small crystals of lime, technically called *raphides*, which exist in great numbers in the sap or juice of the daffodil. It is only necessary, therefore, to keep these crystals out of the skin—to prevent them from entering, either through cuts or the cracks caused by chapping, or under the finger-nails.

Liliaceæ.

Hyacinthus orientalis, L., and varieties (the common Hyacinth of gardens).—"Forms of eczema* were said to have been produced in persons handling and cleaning these bulbs. Although the fact was familiar to gardeners, the cause did not appear to have been clearly traced. Experiments and observations at the Jodrell Laboratory, at Kew, had shown that both dry and moist scales were capable of producing considerable irritation in certain cases when applied directly to the skin. There was little doubt that the raphides were the prime agents. These needle-shaped crystals (composed of oxalate of lime) varied from $\frac{1}{100}$th to $\frac{1}{200}$th of an inch in length, and were arranged in close bundles, easily dispersed by rubbing the dry scales. In the growing plants they were doubtless protective, as snails, for instance, avoided hyacinth bulbs, but attacked others growing close by. Roman hyacinths (var. *albulus*) were understood to cause greater irritation than other varieties.

"Dr. D. H. Scott described some experiments which he had tried, tending to confirm the conclusion that the irritation of the skin produced by contact with the bulb scales of hyacinths is due immediately to puncture by the numerous raphides."

Aroideæ.

Richardia æthiopica, Spreng. ("Lily of the Nile" of gardeners, the common "Arum Lily" of Australian gardens).—Mr. J. Y. Johnson,† of Funchal, Maderia, shows that this plant is, like Hyacinthus, responsible for a form of eczema.

The laundresses of Funchal had tried to utilise the starch obtainable from the corms, but complained of the irritation in the hands produced by it, which, on examination, was found to result from the presence of numerous needle-shaped raphides.

In the discussion which followed the reading of a paper on this subject before the Therapeutic Society of London, Dr. Crichton said that green elder leaves were very powerful irritants, and in one case in which he had ordered an application of elder-flower ointment, the druggist, having no flowers of the elder at the time, used the green leaves instead, but this produced very violent irritation. The common buttercup is also very irritating if applied to the skin.

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*Dr. Morris, C.M.G., in *Proc. Linn. Soc.*, 5th November, 1896.

† *Proc. Linn. Soc.*, 21st January, 1897.

APPENDIX I.

Irritant Woods.

In connection with our article on "Plants and Skin Irritants," printed on p. 110, the following contribution on "irritant" wood, which we extract from the *Journal of the Royal Society of Arts,* is interesting:—

In the course of the past year inquiry was made by the Factory and Workshop Department into the effect of irritant woods, and the extent to which they are used in this country. For example, in the case of satin-wood, there was inquiry into (1) the extent and class of work in which it was used; (2) the evidence there is as to its irritant action on the skin; (3) the precautions taken in its use. Much confusion was found as to the kind of wood referred to as satin-wood, the two covering East and West Indian satin-wood and satin walnut. The first two are practically confined to high-class furniture and furniture-making, and to decoration of cabins and overmantel work in ships. Occasionally thermometer stands, backs of toilet brushes, and similar articles are made of it. In those trades it is used as an inlay or veneer, involving little exposure to irritant dust. East Indian satin-wood possesses much more irritant properties than the West Indian variety. Satin walnut appears to be no more harmful than deal. The East Indian wood is only used in two shipyards. It causes an eruption on the skin of the worker exposed to the dust or shavings produced during manufacture; but some persons are much more susceptible to its effect than others. One man stated to the inspector that if he only placed a shaving of the wood on the back of the hand, it caused a sore on the skin at that point. The injurious effects, however, appear to be only temporary. Exhaust ventilation is in use for carrying off dust, &c., from the machines in most of the works, including one of the shipyards in which the East Indian wood is used. Reference to occasional contact action on the skin is made as to teak by Mr. Inspector Wright (North London), who refers to reports of "swollen arms and eyes," by Mr. Shannin (Liverpool) and by Mr. Grant (Preston), as to teak and olive-wood. The inspector in Sheffield states that "in the manufacture of knife scales and tool handles the following woods are considered to be irritant:—Some of the ebonies, magneta rose-woods, West Indian box-wood, cocos-wood, and partridge-wood. Irritation of the eyes and nose is caused also by woods of the mahogany type. East Indian wood had to be discarded in the shuttle trade owing to its irritating action on the eyes." Mr. Lewis (Manchester) states that salica-wood, from Cuba, was stated to give off "a fluffy dust under the machines and hand planes, the effect of which upon the workers is to cause a running of the eyes and nose, and a general feeling of cold in the head. The symptoms pass off in an hour or so after discontinuance of work." Eczematous eruptions are said to be produced by the so-called Borneo rose-wood—a wood used owing to its brilliant colour and exquisite grain in fret-saw work; but the Director of the Imperial Institute, Sir Wyndham Dunstan, who has interested himself in this wood, has failed to discover injurious properties in it.—*Gardeners' Chronicle*, 29th August, 1908, p. 167.)

APPENDIX II.

Poisonous Plants of Indiana.

A series of experiments have been made with the reputed poisonous plants of this State, which tend to show that the irritation of the skin caused by many of them is due to two causes, viz., the presence of some specific irritant, and in other cases, as in *Arctium* and *Xanthium*, to mechanical causes. A number of species were experimented on, twenty-two persons submitting themselves to trial. The plants found to act in a greater or less degree as irritants to the skin are mentioned in the order of their virulence, viz., *Rhus vernix*, Linn.; *Rhus radicans, Euphorbia corollata, Cypripedium hirsutum, Anthemis cotula, Leptilon canadense, Clematis virginiana*, and *Bidens frondosa;* but all except the first three or four may be handled with safety by

ordinary persons who have not a specially sensitive skin. The author considers the *Primula obconica* to cause irritation only as a traumatic effect. [This is certainly not the case in Great Britain.—Ed. *P.J.*] The following plants, which have been described as causing irritation of the skin, were not found to show unpleasant results, viz.:—*Alisma plantago, Arisœma triphyllum, Arum dracontium, Symplocarpus fœtidus, Phytolacca decandra, Actœ rubra, Anemone quinquefolia, Sanguinaria canadensis, Drosera rotundifolia, Euphorbia maculata, E. humistrata, E. nutans, E. commutata, Lobelia inflata,* and *Solidago odora.* The expressed juice of *Polygonum hydropiper* and *P. punctatum* caused irritation when applied to the mucous membrane, but not to the skin; and the powder of dried *Phytolacca decandra* and of *Podophyllum peltatum* caused persistent irritation to mucous membranes.—Stanley Cooper (*Proc. Indiana Acad. Sci.*, 1906, 51-63, quoted in the *Pharm. Journ.*, London, 24th February, 1906.)

Disease amongst Turkey Poults.

On the 1st November, when on a visit to the Wagga Experiment Farm, Mr. A. L. Wyndham, the Poultry Expert there, drew my attention to a disease amongst fifty turkey poults, which was new to him, and also to myself.

The symptoms were an unthrifty condition in the affected birds, which were walking on their heels, the toes inclining upwards and not touching the ground at all.

The following treatment was decided upon:—A handful of powdered wood charcoal and 2 drams of powdered sulphate of iron was added twice daily to a ration consisting of 1 quart each of bran and pollard, mixed with separated milk. Crushed green bone was also prescribed, as well as lime in the drinking water.

On my next visit to the farm on the 15th November, I found forty-eight of the diseased poults cured, and the remaining two in better health. I was informed that the poults showed improvement shortly after treatment was commenced, and that it was steadily maintained; a result I consider due to the care and attention shown in carrying out the treatment.

I was told by Mr. Wyndham that he hears this disease exists in other parts of New South Wales, and also in Victoria. As I have come to no definite decision as to the cause of the disease, which will be a matter for future attention and investigation, we will be glad to hear from any readers of the *Agricultural Gazette* who have had experience of similar affection in turkeys, and can give us any information in connection therewith.

T. G. PALGRAVE, M.R.C.V.S.,
Government Veterinary Surgeon.

Useful Australian Plants.

J. H. MAIDEN,
Government Botanist and Director, Botanic Gardens, Sydney.

No. 105. *Andropogon brevifolius*, Swartz.

Botanical Name.—Andropogon, Greek, *andros*, of man (man's), *pagon*, a beard, in allusion to the tufts of hairs on the inflorescence, thought to resemble a man's beard; *brevifolius*, Latin, *brevis* short, and *folium* a leaf.

Synonym.—A. fragilis, R.Br.

Brown had the knack of giving suitable names to plants. The inflorescence, and indeed the whole plant, is exceedingly brittle.

Swartz' specific name is suitable also, for the leaves are usually only 1–2 inches long, a shortness unusual in the genus.

Vernacular Name.—I know of none.

Botanical description.—A. fragilis, R.Br. A slender, decumbent, much branched grass, attaining sometimes 2 feet or more, usually glabrous.

Leaves narrow, rather short, the upper ones passing into sheathing bracts.

Panicle leafy, slender, secund, consisting of few spikes on very unequal slender peduncles, each with a narrow acute sheathing bract below the spike.

Spike slender, 1 to 1½ inches long, with a short hyaline obscurely cup-shaped bract enclosing each notch.

Sessile spikelets about 2 lines long, very narrow; outer glume rigid but thin, faintly nerved, the two lateral nerves more prominent, second glume keeled, acute, third very thin and hyaline; terminal glume thin and hyaline, divided almost to the base into two narrow lobes, the awn between them shortly exserted.

Pedicellate spikelets reduced to a single narrow empty glume tapering into a fine awn, or sometimes in the terminal spikelets acute only. (B.Fl. vii, 535.)

Fodder value.—Very little is known about this grass, particularly in Australia, but now that it is shown not to be entirely a tropical species (in Australia it was formerly believed to be confined to coastal tropical Queensland), intermediate localities will doubtless be found, and the value of the grass accurately ascertained.

I believe it to be a really valuable grass, like so many of its close relations.

Habitat.—Narrabri West, New South Wales.

Recorded previously from Queensland and North Australia, not further south than the Endeavour River. The Narrabri specimens agree exactly with R. Brown's type-specimens from the Endeavour River. We have specimens collected by Banks and Solander in 1770, at the locality in

question, on the occasion of Captain Cook's discovery of Eastern Australia. R. Brown described it erroneously as a new species, but it is now recognised to be identical with *A. brevifolius*, common in India, and distributed over the tropics of the globe.

Recorded by Mr. Betche and myself as new to New South Wales, in the *Proceedings of the Linnean Society of New South Wales*, xxxiii (1908).

EXPLANATION OF PLATE.

A. One pair of spikelets and a part of the rhachis.
- *a.* Part of the articulate rhachis.
- *b.* Sterile spikelet, reduced to a single empty glume.
- *c.* Fertile spikelet.

B. Fertile spikelet dissected so as to show the single glumes.
- *a.* Outer or first glume.
- *b.* Second glume.
- *c.* Third glume.
- *d.* Fruiting or fourth glume split nearly to the base and with an awn between the lobes.
- *e.* Grain.

C. Grain.

(The specimen figured is that collected by Mr. Boorman at Narrabri West.)

Malting Barley.

In November issue, page 1031, under the heading "Characteristics," reference is made to what, in the opinion of Mr. Chas. Redwood, head maltster to Messrs. Toohey, Ltd., are the four essential and six non-essential characteristics of malting barley.

Lest there should be any misunderstanding on the part of growers submitting barley for sale or for competition at shows, Mr. Redwood wishes to point out that all ten (10) qualities indicated, viz., Vitality, Condition, Maturity, Odour, Size, Weight, Uniformity, Colour, Appearance of Skin, and Age, are taken into consideration by the maltster in arriving at the value of a sample of barley for malting purposes, but the four qualities, Vitality, Condition, Maturity, and Odour, are of paramount importance.

ANDROPOGON BREVIFOLIUS, Swartz.

Some Granite Soils of New South Wales.

H. I. JENSEN, D.Sc., Chemist's Branch.

Introduction.

To surveyors, geologists, botanists, and others whose occupation takes them to many parts of the State and who have been trained to observe Nature closely, it is a well known fact that a marked relationship exists between the soil, the geological formation, and the flora. Excepting the excellent studies of Mr. R. H. Cambage, F.L.S., on the dependence of the nature of our forest flora on geological formation,* nothing has been done in this connection. With the approval of the Under Secretary it has, therefore, been decided to commence in the Chemist's Branch of the Department a series of systematic studies of the relationship that exists between various rock formations and the soils which constitute their disintegration products. Mr. Guthrie's paper on the "Soils of the County of Cumberland"† may be taken as the starting-point of this work. In that paper the average composition of Hawkesbury Sandstone and Wianamatta Shale soils is given as well as the analyses of the parent rocks.

General Observations.

Those who have travelled much in the State must have noticed the uniformity of the soils which cover any geological formation of considerable extent, such as the Hawkesbury Sandstones, the Wianamatta Shales, or the Narrabeen Shales of the vicinity of Sydney. A close observer of the Hawkesbury Sandstone soils would also have noticed that three varieties occur, typical of the hill-slopes, the small gullies, and the large alluvial flats respectively. These three varieties occur almost invariably in similar places in all parts of the area. Thus on the Blue Mountains at Glenbrook we get a sandy or gravelly loam, which is repeated with remarkable similarity on the hills and hill-slopes on the North Shore Line, the Hawkesbury, Leura, and Katoomba, and on it the same forest flora occurs as far as climatic differences permit. In the beds of the rapidly-running rivulets and the gullies through which they flow we generally find a coarser gravelly soil consisting mainly of quartz pebbles and sand, the finer silt having been carried away in suspension. Though this kind of soil is wretchedly poor in plant-food it often supports a denser growth of vegetation than the hills, a fact which is due to water carrying mineral plant-food in solution, constantly soaking through the gravel along these water-courses.

On the broad alluvial plains we get clays and clayey loams, for over such places the flood-waters of rivers and creeks have had their speed reduced and

* Proc. Linn. Soc. of N.S.W., various volumes.

† *Agricultural Gazette of New South Wales*, Vol. IX, 1898, p. 481.

have therefore deposited their suspended silt and clay. These lands are the most fertile—though the most difficult to work, and as often as the clays have been deposited by creeks coming from one geological formation only, so often they are exactly alike in nature and in the flora they bear.

When on any part of the Hawkesbury Sandstone area a soil occurs which is different from the normal, we can generally find a volcanic dyke or shale bed outcropping near by.

These remarks, which relate especially to the Hawkesbury Sandstone soils, apply to an equal degree to the soils of all distinctive rock formations. One may also observe that similar geological formations in distant parts of the State often give similar soils and types of forest flora. Thus the Trias-Jura Sandstones of Southern Queensland and of the Clarence River and the Permo-Carboniferous Sandstones of the Pigeon House Range behind Nowra have the same class of soil as the Hawkesbury Sandstone, and the same type of vegetation, though climatic differences cause different species to flourish in different places.

These facts of common observation show the importance of a chemical investigation of the type-soils of various important rock formations.

It must be borne in mind that although the character of the soil depends very largely on the rock formation, it is also affected by the rate of weathering or rock decay, which is partly a function of the mineral composition of the rock and partly a function of climatic influences; and the steepness of the slope on which the soil is found also helps to decide its composition, inasmuch as the removal of the detritus is more rapid the steeper the slope. Hence a sandstone or granite soil on the western plains may be much better than a coastal soil of similar origin, removal of waste having been much slower; but a similar western soil on a hill slope, where rain and wind carries away all comminuted particles, may be infinitely worse than a corresponding soil similarly situated in a moister climate, since rock decomposition proceeds more slowly in an arid climate.

This paper deals particularly with some granite soils which have been carefully analysed by the usual method of getting the fine soil into solution in concentrated hydrochloric acid. Though this method does not give a very clear idea of the amount of immediately available plant-food in the soil, yet it is a very satisfactory way of making a general comparison of different soils.

Characteristics of Granite Soils.

Granite is a coarsely-crystalline rock consisting essentially of the minerals quartz, felspar, mica, and hornblende. Of these minerals hornblende and the calcic varieties of felspar weather fairly rapidly, mica less rapidly, and quartz and the acid felspars very slowly. Owing to the disintegration of the more basic minerals the rock breaks up, leaving a sand consisting of the more acid minerals. Hence the weathering of granite results in the production of sandy loams. Sandstone consisting mainly of quartz particles yields soils of a very similar texture, but, on the whole, much poorer in plant-food.

Minerals of Granite.

The minerals of granite are :—

1. Quartz.—Consisting of pure silica.
2. Orthoclase Felspar.—Consisting of potassium-aluminium silicate.
3. Albite Felspar.—A sodium-aluminium silicate.
4. Plagioclase-felspar.—Soda-lime-aluminium silicates.
5. Black Mica (biotite).—A hydrated potassium-magnesium-iron-aluminium silicate.
6. White Mica (muscovite).—Hydrated potassium-aluminium silicate.
7. Hornblende.—Calcium-magnesium-iron-aluminium silicate.

As accessory constituents, iron ores and apatite are the commonest, and the latter is of great importance, being the source of the phosphoric acid of soils.

From the list given above it will be readily seen that unless a granite contains plagioclase and hornblende, which generally co-exist when present at all, a great poverty in lime is to be expected in the soil, since none of the essential minerals contain lime.

Variation in Granite Soils.

Granite soils vary much among themselves, according to the nature of the parent rock and the climate. Thus we may divide granite soils into groups, as in the following arrangement :—

A. Soils of Acid Granites resulting from—

1. Muscovite granite (quartz, orthoclase, and muscovite)—very poor soil.
2. Biotite granite (quartz, orthoclase, and biotite)—poor soil.

B. Soils of Basic Granites resulting from—

3. Hornblende-biotite granite (hornblende, orthoclase, quartz, biotite)—fair soil.
4. Tonalite (quartz, orthoclase, plagioclase, hornblende, and mica)—fair soil.

The hill-slope variety of first two soils are typically grey or yellowish sandy loams, and of the last two, reddish to brownish loams.

Texture of Granite Soils.

Granite soils are generally loose, friable loams, containing a considerable proportion of sand and gravel. Drainage and aeration are, therefore, very good, and the soil is easy to work. The capillary power is usually good, and the water capacity varies from poor to fair. The great porosity of granite soils is often a disadvantage, since it allows too much air, warmth, and water to get to plant-roots, and in dry times leads to the scorching of the crops. Besides, in very sandy soils, phosphates and potash are not easily fixed, and easily suffer leaching.

In alluvial flats in granite areas, where silt has been deposited from suspension in water, a sour, impervious clay, consisting essentially of comminuted felspar particles, is sometimes found. This may exhibit a good water capacity. The capillary power is usually very poor. If derived from orthoclase felspar this clay may be quite as poor in lime as the poorest of the very sandy loams.

The granite soils of Bathurst, Bega, and Cowra have been analysed, and are taken as typical of the soils of the basic granite areas.

Petrology of Bathurst and Cowra Rocks.

The Bathurst rock, which yields the soil submitted for analysis, is a holocrystalline coarse-grained rock, with uneven grain size and hypidiomorphic granular texture. The chief mineral constituents are acid plagioclase, orthoclase, quartz, greenish hornblende decomposing to chlorite, brown biotite also in process of decomposition; minor accessories such as apatite and sphene, and decomposition products such as calcite, chlorite, kaolin, and sericite. This rock was submitted to analysis, and, as the result shows, the presence of plagioclase and hornblende ensures a satisfactory percentage of lime. The apatite yields lime and phosphoric acid to the soil, and the orthoclase felspar has yielded potash.

The Cowra granite is a close-grained rock of medium grain size, in which the minerals nevertheless show deep decomposition. It is holocrystalline and even in grain size. The texture is allotriomorphic granular with granophyric fabric in places.

The constituents are quartz, orthoclase, hornblende, topaz, rubellite (fibrous tourmaline), biotite, and plagioclase. The decomposition products consist of kaolin, sericite, chlorite, and zeolites; and the accessories are sphene and apatite.

The composition of the typical granites of Bathurst and Cowra is as follows:—

	Bathurst granite. per cent.	Cowra granite. per cent.
Silica, including titanic acid ($SiO_2 + TiO_2$) ...	65·66	66·68
Alumina and phosphoric acid ($Al_2O_3 + P_2O_5$) ...	15·03	14·96
Iron, estimated as ferrous iron (FeO)	6·17	5·88
Lime (CaO)	6·40	3·83
Magnesia (MgO)...	2·38	1·98
Potash (K_2O)	2·91	2·44
Soda (Na_2O)	2·51	3·55
Loss on ignition	0·44	1·47
Sum	101·50	100·79

Nature of the Soils.

The Cowra soil is a red friable loam. That yielded by the Bathurst rock is a lighter coloured grey to yellowish loam. The Bega soils are mostly grey loams. The following table (Table I) gives the composition of typical surface soils from each locality mentioned:—

TABLE I.—Comparison of Type Soils of Basic Granites.

Locality.	Colour.	Reaction.	Water Capacity. per cent.	Capillary Power.	Clay, per cent.	Lime (CaO), per cent.	Potash (K_2O), per cent.	Phosphoric Acid (P_2O_5), per cent.	Nitrogen (N), per cent.	Volatile, per cent.	Remarks.
1. Bathurst Experiment Farm.	light yellow.	strongly acid.	poor, 25	good ..	28·8	·160	·111	·072	·140	3·66	Type soil.
2. Cowra, Experiment Farm.	light red	acid ..	fair, 30..	excellent	36·1	·171	·202	117	·084	3·15	Redistributed by water.
3. Bega District, average of six samples.	dark grey	,, ..	good, 38·8	fair ..	35·0	·356	·218	·116	·208	8·42	The individual analyses are given in Table II.

This table shows that a coastal climate such as that of Bega favours rock decomposition, so that the soils from this district are on the whole richer than the other two, and are capable of supporting a denser herbage, which results in a higher percentage of volatile organic matter in the soil. Yet this statement must be qualified by the remark that the soils of Bathurst, Cowra, and other inland granite areas are much more uniform over a large extent of country. By reason of the level nature of the country and the smaller rainfall, redistribution of the detritus has taken place to a smaller extent than in coastal districts.

In the Bega district many soils exhibit a poverty in potash. This fact is attributable to two causes—(*a*) the potash having been leached out by rain-water, and (*b*) a dense arboreal vegetation having exhausted the potash. In the latter case removing the trees and allowing the ground to lie under grass will, by degrees, restore the potash as weathering proceeds, unless it be in a position where soluble salts are readily washed away, as on a steep hill-slope. When that is the trouble, terracing the ground with stones or tree trunks, as in the mountain vineyards of Italy, will be of great benefit.

The following table illustrates the variable composition of the granite soils of the Bega district :—

TABLE II.—Analyses of Granite Soils, Bega District.

Locality.	Colour.	Reaction.	Water capacity, per cent.	Capillary power.	Clay, per cent.	Lime (CaO), per cent.	Potash (K_2O), per cent.	Phosphoric Acid (P_2O_5), per cent.	Nitrogen (N), per cent.	Volatile per cent.
1. Ayrdale No. 2 ..	grey .	acid ..	35·5	6	34·5	·225	·023	·070	·154	8·20
2. Peak	light chocolate.	,, ..	36·5	8	34·9	·616	·417	.152	·364	10·98
3. Warragaburra ..	grey ..	,, ..	36·0	6½	29·9	·271	·112	·109	·168	7·57
4. Numbugga ..	light ..	,, ..	34 0	5	36·2	·566	·341	157	·238	9·86
5. Schuebach's ..	grey ..	,, ..	23·0	3¾	44·5	·118	·101	·070	·126	5·52
6. Daisy Bank	dark ..	,, ..	41·5	8	30·0	·340	·314	·140	·196	8·40
Average ..	..	..	38·8	6¼ =good.	35·0	·356	·218	·116	·208	8·42

Table III gives the composition of a number of a number of Bathurst soils analysed by the Department, and Table IV gives the composition of some Cowra soils. A glance at these tables reveals that much more uniformity in composition exists in the soils of inland areas than in the Bega district.

TABLE III.—Some Granite Soils of the Bathurst District.

Laboratory Number.	Colour.	Reaction.	Water Capacity.	Capillary Power.	Clay	Lime (CaO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).	Nitrogen (N).	Volatile.	Remarks.
1. Experiment Farm, near Silo.	light yellow.	strongly acid.	very poor 25	good 5½ in.	28·8	·160	·111	·072	·140	3·66	Typical virgin soils, specially collected by Mr. Peacock.
2. Experiment Farm, Orchard Gate.	light brownish.	,,	good 42	good 7 in.	59·2	·249	·184	·094	·154	·534	
3. No. 150	light	neutral.	26	..	19·2	·170	·095	·039	·061	1·39	
4. No. 249, Bathurst Plains	..	..	44	..	48·2	·185	·182	·132	·154	7·07	
5. No. 394	..	acid.	55·5	..	53·7	·270	·437	·219	..	..	
6. No. 1,103 ..	brown	faintly acid.	40	..	19·8	·172	·095	·079	·119	4·39	
7. No. 1,104 ..	chocolate	,,	41	..	27·1	·150	·153	·070	·105	3·73	
8. No, 1,396 ..	dark	,,	30·5	excellent	23·6	·224	·027	.057	·105	4·43	
9. No. 1,397 ..	,,	,,	39	,,	22·3	·110	·133	·036	·077	2·49	
10. No. 1,900 ..	brown	very strongly acid.	41	,,	57·1	·185	·266	·070	·126	7·40	The analyses from No. 3 to No. 20 are of farmers' samples of virgin or unmanured soil. Their derivation from Bathurst granite is in all cases practically certain.
1. No. 1,901 ..	brownish	very strongly acid.	37	very good	47·6	·190	·211	·065	·084	6·05	
12. No. 1,902 ..	dark grey	very strongly acid.	36·5	,,	46·7	·265	·161	·077	·112	5·41	
13. No. 1,816 ..	brown	faintly acid.	38	excellent	45·5	·119	·109	·077	·070	3·17	
14. No. 1,802 ..	dark brown	strongly acid.	43	very good	49·7	·184	·136	·094	·056	4·95	
15. No. 1,803 ..	,,	,,	39	,,	51·7	·190	·085	·099	·084	4·55	
16. No. 1.804 ..	dark grey	,,	37	,,	55·2	·240	·101	·083	·084	4·35	
17. No. 1,805 ..	brown	,,	42	,,	50·4	·163	·171	·086	·056	5·05	
18. No. 1,806 ..	grey	,,	32·5	,,	34·4	·195	·169	·083	·056	3·40	
19. No. 654	..	,,	35·7	..	29·1	·030	·060	·054	·052	3·53	Perhaps not of granite origin.
20. No. 1,902 ..	dark grey	very strongly acid.	36·5	very good	46·7	·265	·161	·077	·112	5·41	
Average ..	..	strongly acid.	37·9	good to excellent.	40·8	·186	·152	·083	·095	4·51	

TABLE IV.—Analyses of Cowra Soils.

Laboratory Number.	Colour.	Reaction.	Water Capacity.	Capillary Power.	Clay.	Lime (CaO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).	Nitrogen (N).	Volatile.	Remarks.
			Per cent.								
Experiment Farm.	red	acid	30	excellent	36·1	·171	·202	·117	·084	3·15	Typical virgin granite soil, specially collected, formed by decomposition of granite *in situ*.
Do. (No. 1690)	red	acid	40	,,	31·0	·240	·123	·089	·070	4·02	Samples analysed for Government Experiment Farm, mostly special varieties differing from the type soil of the district, having been mechanically redistributed by water.
Do. (No. 1691)	brown	faintly acid	39	very good	39·4	·380	·116	·090	·070	3·96	
Do. (No. 1643)	black	,	48·5	poor	86·5	·570	·124	·070	·052	7·69	
Do. (No. 1725)	brown	,,	57	fair	99·7	·653	·268	·193	·126	7·59	
Do. (No. 1726)	,,	acid	55	,,	98·0	·581	·303	·160	·084	7·57	
Do. (No. 1727)	,,	strongly acid	59	,,	99·0	·537	·450	·156	·098	7·85	

The numbers refer to the laboratory numbers in the departmental records of soil analyses.

With a view of determining the progressive stages of rock decomposition, some Bathurst soils, kindly supplied by Mr. R. W. Peacock, of the Bathurst Experiment Farm, and representative of every 6 inches down to 3 feet, were analysed. The following table (Table V) shows the results of the examination:—

TABLE V.—Change in Composition with Depth (Bathurst Experiment Farm).

Depth and Locality.	Colour.	Reaction.	Water Capacity.	Capillary Power.	Clay.	Lime (CaO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).	Nitrogen (N)	Volatile.	Remarks.
No. 1. Near silo—	from decomposition of granite *in situ*.		Per cent.								
0″ to 6″ ..	light yellow	strongly acid.	25	good	28·8	·160	·111	·072	·140	3·66	
6″ to 12″ ..	reddish	acid.	27	excellent	51·0	·218	·452	·069	·112	5·83	Red colour due to ferric oxide.
12″ to 18″ ..	,,	faintly acid.	44½	,,	61·8	·349	·559	·063	·112	8·55	
18″ to 24″ ..	yellowish	,,	45	,,	44·8	·333	·435	·104	·098	7·72	Contains lumps of decomposed granite.
24″ to 30″ ..	light yellowish.	,,	42	,,	46·8	·446	·582	·122	·070	6·84	
30″ to 36″ .	yellow	,,	39	,,	34·7	·369	·558	·063	·042	6·07	Very lumpy with decomposed granite.
No. 2. Near orchard gate—	granite detritus redistributed by water.										
0″ to 6″ ..	light brown	strongly acid.	42	good	59·2	·249	·184	·094	·151	5·34	
6″ to 12″ ..	grey	very faintly acid.	26	,,	54·2	·184	·103	·012	·070	1·92	
12″ to 18″ ..	dark grey	neutral.	42	fair	79·1	·307	·371	·052	·070	5·95	
18″ to 24″ .. 24″ to 30″ .. 30″ to 36″ ..	brownish	very weakly alkaline.	53	poor	85·6	·420	·425	·064	·084	6·09	

This table is instructive as showing that the subsoil in granite areas is invariably richer in mineral plant-food, especially potash, than the surface soil. The phosphoric acid gets slightly and the nitrogen considerably less at a depth, but the lime and potash are much higher. It follows from this that when a granite surface soil gets depleted in potash a good supply can be introduced by deeper ploughing. In sandstone country this is not true nearly to the same extent, a fact which makes a poor granite soil an infinitely better asset than a poor sandstone soil. So as to get a preliminary comparative idea of the relationship between geological formation and soil the following table is instructive:—

TABLE VI.—Relation between Geological Formation and Soils.

Formation.	Usual Colour.	Usual Reaction.	Water Capacity.	Capillary Power.	Clay, per cent.	Lime (CaO), per cent.	Potash (K_2O), per cent.	Phosphoric Acid (P_2O_5), per cent.	Nitrogen (N).	Volatile.	Remarks.
Slate	light ..	acid ..	poor, 28·2	good ..	41·6	·066	·055	·069	·066	4·26	Average of three typical slate soils.
Sandstone ..	,, ..	,, ..	low ..	,, ..	generally low.	·106	·066	·137	·133	var.	See *Agric. Gazette*, 1898, pp. 481 to 487.
Piliiga Scrub ..	,, ..	,, ..	poor ..	,, ..	13·0	·152	·019	·045	·056	9·75	Analysis of one typical sandy loam.
Wianamatta Shales. ..	,, ..	,, ..	low ..	poor to good.	generally high.	·136	·133	·096	·140	var.	See *Agric. Gazette*, 1898, pp. 481 to 487.
Granite	,, ..	,, ..	fair, 37·7..	good ..	38·0	·190	·140	·109	·103	5·34	Average of 128 analyses.
Basalt	brown to black.	neutral..	good, 4·80	poor to fair.	63·4	·565	·084	·107	·170	8·00	Mean of four typical analyses.
Limestone ..	dark ..	alkaline..	good, 44·9	very variable.	56·4	·765	·350	·181	·104	6·76	Mean of ten typical analyses.
Black Soil Plain.	black ..	neutral..	very good 62·7	very variable.	78·0	·625	·330	·174	·056	7·00	Mean of six typical analyses.
Alluvial	,,	,,	good, 46..	......	84·8	·686	·242	·291	·165	8·28	Mean of five analyses.

NOTE.—The typical black soils used in the above computation are from the Namoi and Castlereagh Basins; the alluvial soils from the Hunter River Valley and Bathurst.

From this table it is readily seen that our best soils are those yielded by limestone and basalt, and those of the black-soil plains and river alluvials. But all of these are much heavier to work than the light sandy soils.

The worst soils are those derived from slate and from the decomposition of sandstones of the Hawkesbury Sandstone type.

Granite soils are not nearly so rich as many other types, but they are very loose and easily worked. When exhausted in potash they can be improved by bringing up the subsoil.

The limestone country is not benefited to the same extent by deeper ploughing. The analyses available (chiefly from the Barren Jack area, collected by Mr. Guthrie), show that limestone soil gets much richer in lime on going down, but does not get sensibly richer in potash. This is to be expected, as the underlying rock is poor in that constituent.

The granite soils of New South Wales can be roughly classified into two series, namely, the soils of the acid granites and those of the more basic granites. The Bathurst, Cowra, and Bega rocks would be classed in the second group. (See Table VII.)

TABLE VII.

A. Acid Granite Soils.

Locality.	Clay.	Lime (CaO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).	Nitrogen (N).	Volatile.
Hartley	46·1	·050	·027	·059	·042	3·72
Blayney	43·2	·035	·094	·105	·167	3·67
Adaminaby	38·7	·045	·191	·252	·227	8·22
Trial Bay	54·3	·070	·052	·326	·170	12·70
Wyalong	18·9	·072	·116	·150	·066	4·13
Tenterfield	17·3	·060	·029	·019	·028	1·51
Jenolan	63·8	·103	·194	·135	·168	7·52
Mean	47·0	·072	·117	·174	·145	6·91

B. Basic Granite Soils.

Locality.	Clay.	Lime (CaO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).	Nitrogen (N).	Volatile.
Berridale	20·1	·236	·240	·093	·112	5·21
Wagga	24·9	·118	·586	·069	·067	4·18
Junee	60·2	·223	·208	·094	·056	3·45
Hay	42·0	·159	·266	·099	·042	5·55
Bathurst	28·8	·160	·111	·072	·140	3·66
Cowra...	36·1	·171	·202	·117	·084	3·15
Mean	35·3	·178	·269	·091	·083	4·20

The difference between them is chiefly noticeable in the lime and potash.

Vegetation on Granite Soils.

The notes forwarded to Department with granite soils submitted for analysis show that the basic granites in our Western country support white box, yellow box, kurrajong, apple-trees, and white pine. The acid granites grow chiefly gum, peppermint, stringybark, oak, wattle, and pine.

In the coastal country the basic granites carry spotted gum, red gum, ironbark, stringybark, apple, box, and bloodwood, and the acid granites support blackbutt, white gum, bloodwood, wattle, honeysuckle, zamia, and grass-tree.

Manuring of Granite Soils.

On acidic granite soils lime is a manure which can always be added with good results, and on all granite country the application of bonedust and superphosphate is of value. Potassium salts are not required to the same extent, except when the land is exhausted. In the western country a deficiency of potash can be remedied by deeper ploughing, but in coastal districts where heavy timber has extracted this ingredient the addition of wood ashes is beneficial.

Our coastal granite soils are generally inclined to be sour, a defect which can be remedied by working the soil and applying lime to it.

Another common failing in granite soils is their poverty in humus and nitrogen. This is remedied by growing a catch crop of some leguminous plant and ploughing it under.

It should also be mentioned that magnesia and ferrous iron are important constituents in the soil and necessary for the successful growth of certain crops, and to keep in check certain fungoid pests. While the basic granites contain in their hornblende, augite, and mica both of these constituents in sufficient proportions, the granites of the acid types are extremely deficient in them, especially in magnesium. Therefore, all crops grown on very acid granites in the unmanured state are deficient in chlorophyll and, consequently, also in carbohydrates. Hence their food value will be low. In addition they will be somewhat unhealthy and liable to be attacked by rusts and other pests. The addition of magnesium and ferrous sulphate in small amount (for férrous sulphate in excess is a plant poison) may not only be desirable but necessary, where sandy granite soils derived from very acid granites predominate.

The Possibility of Finding Phosphate Deposits in Australia.

H. I. JENSEN, D.Sc., Chemist's Branch.

I.

THE increasing use of phosphatic manures in the agricultural industry of New South Wales renders it desirable that prospectors should be on the lookout for phosphate deposits. The discoverer of a good body of mineral phosphate in Australia will not only enrich himself, but he will confer a great boon on the agricultural community. Phosphate minerals are easy to work; they require no special treatment to convert them into a marketable form, and they will always command a ready sale.

Phosphoric acid, which is an important plant-food, is constantly being extracted from the soil where intense grazing or cultivation is practised. In our native scrubs, where the plants and animals on dying leave their remains on the ground, most of the phosphoric acid is returned to the soil. But when the animal and vegetable products of the land are taken to the city for consumption no such restitution of phosphoric acid to the soil takes place. To prevent the land from becoming exhausted the addition of phosphatic fertilisers is essential.

Hence, from a national and economic standpoint, prospecting for phosphate would be a more useful occupation than hunting for gold.

The value of a mineral phosphate is judged by the percentage of tribasic calcium phosphate it contains. This compound is insoluble in water, and is converted into superphosphate by the manure manufacturers before it is sold to the farmers. A good mineral phosphate should contain about from 60 to 80 per cent. of the tribasic calcium compound; between 40 and 60 per cent. constitutes a low-grade mineral. The price paid in Sydney for 80 per cent. ore is, approximately, £2 10s. per ton. The presence of iron and aluminium compounds and calcium fluoride in the ore is accounted deleterious, and reduces its value per ton.

II.—Sources of Phosphate Minerals.

Most of the phosphate deposits of economic value throughout the world occur in sedimentary rocks, but occasionally large bodies of mineral phosphate (apatite) are directly the product of igneous activity, as in Canada, Norway, and Estremadura in Spain.

Primarily, all the phosphate of sedimentary rocks was derived from igneous rock. All plutonic and eruptive rocks contain phosphoric acid in small amount, varying from 0·01 to 5·00 per cent. It occurs in these rocks chiefly in combination with calcium, as the mineral apatite (phosphate of lime combined with chloride or fluoride of lime). As apatite is generally one of the most soluble of the mineral constituents of igneous rock, it readily passes

into solution, when the rock decomposes, and it is partly retained by the soil, whence it is taken up by plants and animals feeding on plants, and it is partly carried in solution to the sea. Here it is absorbed by fishes, corals, molluscs, and other organisms, and as these are again consumed by seabirds, it returns in part to the land, where it is left in the excrements of seabirds.

The phosphates of sedimentary rocks may, therefore, be derived from one of the following sources :—

(1) Bird, seal, or fish excrements.
(2) Bones of fishes and of animals.
(3) The hard parts of molluscs, molluscoidea, crustacea, corals, foraminifera, &c.
(4) Remnants of swamp vegetation

Phosphoric acid, like carbon, is constantly changing its place between the animal and vegetable kingdom.

III.—Types of Phosphate Mineral.

The form of calcium phosphate which occurs in igneous rocks is known as apatite. It crystallises in the hexagonal system, and in colour it may be seagreen, blue, red, brown, yellow, or grey. When massive it usually has a greenish tinge. The fracture is subconchoidal and uneven, and the lustre is like that of glass. It is not as hard as quartz, aud may be scratched with a good knife, yielding a white streak. The cleavage is seldom noticeable to the naked eye.

Apatite does not effervesce with acid like calcite. It fuses with difficulty, and after moistening with sulphuric acid it gives a greenish flame before the blowpipe.

Phosphorite is a name given to numerous fibrous, concretionary, scaly, and stalactitic forms of lime phosphate that occur in nature. The colour, like that of apatite, is very variable, but greenish, yellowish, and buff-coloured varieties occur most freely.

Guano is an amorphous substance made up of the droppings of seabirds, bats, and other animals. It is white, grey, brown, or yellowish in colour, and somewhat variable in composition, according to the amount of leaching it has uudergone. In rainless regions and dry caves the phosphorus is present as tricalcic, dicalcic, ammonio-magnesic, and ammonium phosphates. It passes by a number of intermediate substances into true phosphorite.

IV.—Mode of Occurrence and Origin.

A.—*Apatite* occurs in all igneous rocks in small amount, and being their most soluble constituent it easily passes away into the soil and sedimentary formations, to be absorbed into plant and animal life when the rock disintegrates. As a rock constituent it occurs in too minute amount to be of commercial importance. In some cases, however, large dykes and sheets of pure apatite occur in igneous rocks and in metamorphic sedimentary rocks in proximity to great basic plutonic intrusions. The most notable examples are the apatite lodes of Norway and Canada. These dykes and intrusive sheets

owe their origin to vapour action in the period of cooling of the great igneous masses with which they are connected. Vapours and hot waters containing hydrochloric and hydrofluoric acids have circulated in the cracks and joints of the cooling magma, or in the crevices formed in the adjoining sedimentary strata by the thrust of the intrusion. In these passages the phosphoric acid contained in the vapours has been precipitated in combination with lime.

The Canadian apatites are found in dykes and bedded veins, cutting Laurentian metamorphic sediments and basic intrusions. After quarrying the ore is hand-picked, and then contains from 60 to 65 per cent. of tricalcic phosphate.

The Norway apatite lodes are associated with intrusive masses of olivine gabbro. In the gabbro they follow joint cracks, and in the neighbouring schists they follow planes of foliation. Each vein has on either side a zone of contact metamorphism, the felspar of the country rock having been altered to scapolite. The minerals associated with the apatite are magnesia, mica, labradorite, scapolite, ilmenite, rutile, enstatite, hornblende, and pyrrhotite.

B.—Phosphorite occurs both in association with sedimentary and with igneous rock. It may occur either as veins in igneous rock, or bedded in sedimentary or metamorphic rocks, or in lenticular bodies infilling former caves and crevices in limestones, or as an alteration product of limestones underlying guano deposits.

In igneous rocks phosphorite may be either a primary product of vapour action like the apatite described above, or a secondary product formed by the alteration of calcite veins by solutions containing phosphoric acid filtering down from overlying guano beds.

Secondary phosphate rock owes its origin to the decomposition of organic remains. Guano, bone breccia, decaying animal and vegetable matter, &c., have the soluble phosphates of lime (dicalcic phosphate), magnesia, and ammonia leached out by meteoric waters containing carbon dioxide. The soluble phosphate solution filtering down comes into contact with carbonate of lime (limestone or calcite veins), and alters it to phosphate, liberating at the same time carbon dioxide and ammonia.

The occurrence of phosphorite deposits at the junction of two formations of a different character is not unusual, especially when one of the formations is a fossiliferous limestone. Its occurrence where there is an unconformity between two formations, or where there is a thinning out of a fossiliferous stratum is also well known.

It is commonly associated with arragonite (fibrous lime carbonate) and calamine (zinc carbonate).

High grade phosphorites and apatites often contain from 70 to 80 per cent. of tricalcic phosphate.

Very often phosphatic limestones and phosphorite beds of any age are overlain by Tertiary and recent beds rich in bone remains. It seems, therefore, that phosphatic rock exercises a preservative action on bones. Hence Tertiary bone beds may be a valuable indication in any district of the occurrence of phosphate rock below.

In South Carolina, concretionary masses of phosphorite left by the weathering of Palæozoic phosphate rock are associated with miocene and pliocene bone remains.

Phosphorite is one of the staple products of Florida. Here it occurs as great lodes, infilling fissures in a formation of Tertiary limestone and calcareous marls. Two theories have been advanced to explain the origin of the phosphates.

The first assumes that at the close of the Tertiary period, when Florida was still submerged, the waters of the ocean were richer in phosphorus than now. Myriads of shellfish and fishes teemed in the sea, and their shells and bones gave rise to a shell limestone. Hordes of wild animals were then driven south by the advancing Ice Age, and they died of starvation around the swamps which were being formed by the slow elevation of Florida. Their bones were preserved in the shell limestone, and at the same time the bones and teeth of sharks and other marine animals driven south by the cold accumulated along the shore. A slight subsidence followed, causing marine sands to be deposited on the shell and bone limestone and loose bone and shell breccia. Elevation followed. After that leaching took place, so as to remove carbonate of lime, leaving in many places a pure phosphate.

The other theory assumes that a mud was deposited on the floor of the Eocene limestone. On elevation this cracked, and the cracks became filled with acid waters, gases, and organic matter. Animals also fell into the crevices and died. By degrees a highly phosphatic rubble formed in them. Further fissuring took place in the Eocene. Later submergence took place, and drifting bones and carcases fell into the fissures. These remains on elevation and conversion into rock were leached, and yielded a rich phosphatic rock.

In Tennessee, Tunis, and Algeria leached phosphate deposits occur in many places, and chiefly where unconformities exist or where a fossiliferous stratum thins out.

In the Pacific Islands (*e.g.*, Ocean Island) the phosphoric acid of the phosphorite deposits was primarily formed from guano, and by the action of phosphatic solutions from guano beds on the underlying coral limestone.

It is therefore seen that phosphorite deposits may originate in the following ways:—

(1) The insoluble residue of leached guano.

(2) By the action of ammonium phosphate solutions from guano beds on underlying limestone.

(3) As a breccia by the erosion of partly phosphatised limestone, the carbonate of lime being softer and more soluble, hence more easily weathered than the phosphate.

(4) By the leaching of bone beds.

(5) By the decomposition of plant and animal remains in dried-up swamps.

(6) By the leaching of coral, foraminiferal, molluscan, and brachiopod limestones. In such cases the phosphorite may be in pockets, either on the surface of the limestone, just under the soil (concretionary), or underlying the limestone on its junction with subjacent formations.

(7) Phosphate deposits of a greenish colour and largely composed of glauconite may also occur in formations of deep sea origin. The "Challenger" soundings off Cape Agulhas prove that phosphate beds are in progress of formation in the deep sea.

Guano Deposits.—Guano may occur unleached in rainless districts or on rainless islands as on or off the coast of South America. It may also occur in dry caves, as in Olsen's Caves, near Rockhampton, Queensland. It is composed chiefly of the excrements of seabirds when found on islands or in coastal districts. In caves it consists mainly of bats' dung.

V.—Where Phosphates might be expected in Australia.

1. *Apatite.*—In many parts of Australia we have Archæan, Cambrian, and ancient Palæozoic formations (gneisses and schists) intruded by gabbroic plutonic rocks. In the Mount Lofty Ranges and Yorke Peninsula of South Australia, in the Australian Alps of New South Wales and Victoria, in the Broken Hill region, in both Southern and Northern Queensland and in the Northern Territory, Western Australia, and Central Australia, we have very ancient schist and gneiss formations.

When the prospector in such regions comes upon any large intruded masses of basic igneous rock, especially gabbro and norite, and he notices an abundance of titaniferous iron (ilmenite), in the wash from these rocks, he is in likely country for occurrence of apatite veins.

2. *Phosphorite.*—Phosphatic rock might be met with in pockets in any of the Palæozoic limestones of Australia, and possibly also as beds in such limestone. Many of our Cambrian, Silurian and Devonian limestones are remarkably rich in organic remains; molluscan, pteropod, brachiopod, trilobite, coral and foraminiferal skeletons constituting the bulk of great limestone formations. Thus, beds of Devonian limestone in the Currockbilly Range near Braidwood, are built up almost entirely of brachiopod shells. Where such formations are followed by an unconformity, and contemporaneous erosion of the deposit has taken place, rich pockets of phosphorite are possible.

The prospector would know an unconformity by a change in dip of the underlying strata from that of the overlying limestone. The limestone would also be followed by a bed of coarse shingle.

In the Palæozoic sedimentary rocks, glauconitic phosphate rock of deep sea origin might also occur. It would be dark in colour, stained by manganese; and it might contain numerous fossils of deep sea type, *e.g.*, bones and teeth of fishes, trilobites (blind form), cephalopods, pteropods, sponges, foraminifera, diatoms and radiolaria.

We next have to inquire if we can expect anywhere in Australia a counterpart to the Florida phosphate deposits. In Florida there was an elevation of Tertiary limestone deposits, accompanied by the drying up of salt marshes and by an inroad of mammals that were driven south by the great Ice Age. As the marshes dried up, the animals died in large numbers of starvation and left their bones in caves and in solution fissures in the limestone. Bats and birds preying upon the carrion left their guano in caves and fissures.

The limestone, in itself rich in phosphoric acid from the high proportion of foraminifera in it, was further enriched in that ingredient by the leaching out of carbonate of lime.

In Australia we have had no great universal Ice Age in Tertiary times. But we have had an almost equally great extermination of animal life by the desiccation of the now arid interior. It is believed by Australian geologists that, until the Pliocene or Early Pleistocene large stretches of the interior were covered by vast lakes. Where the land is now rainless, it then received copious showers. Immense herds of marsupials lived on the shores of the lakes and along the rivers which flowed into them. Gradually the climate grew drier. The animals of the Australian interior were, as a result, scattered in two opposite directions. As the lakes diminished in size and the moist zone around them contracted great herds of animals would draw together around the diminishing waters, and die when the lakes dried up completely. In many parts of our interior great masses of bones of extinct animals are found, and where such is the case the underlying rock is likely to be a phosphatic limestone, since such limestone in particular, exercises a preservative action on bones.

While some of the animals migrated inwards towards the shrinking lakes, others migrated outwards towards the Gulf of Carpentaria and the Great Australian Bight. In both of these regions considerable elevation has taken place in Pleistocene times, and Tertiary limestones, rich in foraminifera have been raised high and dry just like the Pleistocene of Florida. The troupes of animals, always hugging the coastal region, would in droughty years die in great numbers, and their remains falling into cracks in the limestone formation might give rise to phosphorite. It is, therefore, possible that in the Tertiary limestones from the Riverina to the Bight, and in the Gulf country of Queensland may contain pockets of phosphatic rock, similar to those of Florida.

Bone Beds.—In several of the Chillagoe Caves, N.Q., bone beds of considerable dimensions occur. The occurrence is probably fairly common in the northern limestone country, and some of these deposits may be of commercial value.

Guano.—In our limestone formations, and especially near the coast of tropical Australia, where luxuriant scrubs provide food for an abundance of animals, large caves often contain great thicknesses of bat guano. Some, like Olsen's Caves, are of commercial importance.

To summarise, phosphate deposits may occur in Australia :—

(1) As apatite in very old schist and gneiss formations which have been intruded by gabbro.

(2) As phosphorite in Palæozoic limestones where unconformities occur above them, and leaching by subaerial agencies has taken place.

(3) As phosphorite in Tertiary limestone where animals have died in great numbers on the desiccation of our interior in Pleistocene times. Such occurrences might be met with in Central Australia, the Riverina, and in the country around the Great Australian Bight and the Gulf of Carpentaria.

(4) As bone breccia in limestone caves.

(5) As guano deposits in limestone caves.

Notes on Flour-Strength.

BY F. B. GUTHRIE, F.I.C., F.C.S., AND G. W. NORRIS.

[Read before the Royal Society of N. S. Wales, October 6th, 1909.]

THE term "strength" as applied to flour refers to that combination of qualities which makes a flour valuable for baking purposes. The problem as to what exactly constitutes flour-strength and whether it is possible to devise some ready means of determining this property without having recourse to the always rather unsatisfactory baking test, is one that has engaged the attention of many workers in different parts of the world for some time, and still remains unsolved.

In order to place the problem on a satisfactory basis, the British Home-grown Wheat Committee has arrived at the following definition of flour-strength as "The capacity to make a big well-piled loaf."* Prof. Wood† further points out that this is a complex of at least two factors, size and shape of loaf. The definition thus stated appears to include all the qualities the presence of which render a flour of good baking quality and to provide a clear statement of the problem presented to us.

It does not, as will be seen, include the power of producing weight of loaf. This property depends upon the power of the flour to absorb water, and, although this does not perhaps strictly fall under the definition of strength, we have nevertheless satisfied ourselves that it is a measure of this quality, and that those flours which absorb the larger quantities to produce a dough of a given consistency are invariably those which produce a large well-piled loaf. In using the term "invariably," we mean only to imply that in our own experience, flours with high water-absorbing power are strong flours. All the new strong-flour varieties of wheat created by the late Mr. Farrer, and those which Mr. Sutton, his successor, is making, have been chosen on account of their high water-absorbing capacity. In other words, while this function is not perhaps a necessary condition of strength, it is nevertheless a fairly trustworthy guide, and the water-absorbing power of a flour can be regarded as a measure of its strength in much the same way as the amount of carbonic acid in the air of inhabited rooms is a measure of the vitiation of such air.

It has the additional advantage of being a test which is readily applied and capable of fairly accurate determination, which cannot be said of the baker's judgment. The art of baking depends so much on the skill of the individual

* A. E. Humphries, "The Improvement of English Wheat," Liverpool, 1905, also Humphries and Biffen, Journal Agric. Science, Vol. II, part i, page 1.

† T. B. Wood, "The Chemistry of Strength of Wheat Flour," Journal Agric. Science, Vol. II, part ii, page 139.

that it is a very difficult thing to get two bakers to agree as to the baking quality of a flour to which they are unaccustomed, and still more difficult to obtain fixed data for the factors, size, and shape upon which accurate comparisons may be based. We consider, therefore, that it is of importance to determine the causes of the greater power possessed by certain flours of absorbing water, and the following notes embody the results of a few preliminary experiments in this direction, which, though not conclusive, may nevertheless throw some additional light on the subject.

1. Note on the Water-absorbing Power of different Grades of Flour.

A sample of coarse middlings, as produced by one of the leading millers in Sydney, was taken for the experiment. This product had a water-absorbing power of 45·5 quarts per 200-lb. sack, and contained 9·66 per cent. gluten. The gluten was yellow, coherent, and elastic.

In washing out the dough to obtain the gluten, impurities were noticeable, and it would seem that the usual time (one hour) for standing in dough before washing out is insufficient in the case of coarse products, as the dough during the washing out felt gritty. These middlings were then sifted in order to separate them into finer and coarser grades.

The first portion was retained by a No. 11 dressing silk (112 meshes to the linear inch) and passed through a No. 9 dressing silk (94 meshes to the inch). The second portion was retained by the No. 9 silk and passed through a No. 7 silk (80 meshes to the linear inch). The third portion was that which was retained by the No. 7 silk and passed through a No. 5 silk (64 meshes to the inch). We thus obtained from the original coarse semolina four different grades of varying fineness of division. These behaved towards water as shown in the following table :—

	Water absorption, quarts per 200 lb.	Gluten.
Original coarse semolina	45·5	9·66
A. Portion passing through No. 5 but not through No. 7	44·0	9·78
B. Portion passing through No. 7 but not through No. 9	46·6	10·07
C. Portion passing through No. 9 but not through No. 11	47·0	...

The finer portion of the semolina had a higher water-absorbing power than the coarser, and the original semolina stands about half-way between the finer and coarser portions in this respect. The actual proportions of fine and coarse particles were not determined, so that the exact average could not be calculated.

The effect of fineness of division upon the water-absorbing power was even more apparent when the above products were reduced to flour. Each of the portions A, B, and C, and the original coarse semolina was put through the

smooth rolls separately and reduced to flour until it passed through a No. 14 dressing silk (136 meshes to the linear inch). The result was as follows :—

	Water absorption, quarts per 200 lb.	Gluten.
Original coarse semolina reduced and dressed through No. 14	47·2	9·34
Portion A (passed through No. 5) reduced and dressed through No. 14	47·0	9·32
Portion B (passed through No. 7) reduced and dressed through No. 14	47·4	9·50
Portion C (passed through No. 9) reduced and dressed through No. 14	47·9	...

In the case of portion C, a very small proportion (amounting to ·08 per cent. of the whole) could not be got to pass through the No. 14 dressing silk. In other cases the whole was reduced to flour, dressing through No. 14.

It will be seen that here again fineness of division has increased the water absorbing power of the flour, but the peculiarity is noticed that although all the portions examined in the last table were practically of the same fineness, the water-absorbing powers were not identical, as might have been expected, but varied with the water-absorptive power of the stock from which they were derived.

The above experiments were repeated with a sample of middlings obtained in the departmental mill from a sample of Fife wheat (a strong-flour wheat), the semolina used in the previous experiments being obtained from a soft wheat. The Fife wheat semolina was first separated into three grades.

	Water absorption, quarts per 200 lb.	Gluten.
A. Portion passing through No. 5 but not through No. 7	48·9	12·06
B. Portion passing through No. 7 but not through No. 9	49·3	12·21
C. Portion passing through No. 9 but not through No. 11	50·8	11·74

On reducing these several products separately to flour, and dressing through a No. 14 silk, the following results were obtained :—

	Water absorption, quarts per 200 lb.	Gluten.
Portion A (passed through No. 5) reduced and dressed through No. 14	51·7	11·63
Portion B (passed through No. 7) reduced and dressed through No. 14	52·0	11·48
Portion C (passed through No. 9) reduced and dressed through No. 14.	55·0	11·77

In this case the peculiarity noticed in the previous experiment is even more strikingly exemplified. If the water-absorbing powers of the different grades of semolina are alone considered, it would appear that fineness of

division is the determining factor, but on reducing these different grades to flour of a uniform grade the rather curious fact is to be noted that although further reduction in the size of the particle increases the water-absorbing power, the flour derived from the finer and more absorptive grades of middlings is more water-absorptive than that obtained from the coarser grades.

In the case of the soft wheat this is not very striking, but in the case of the Fife wheat the gradation is quite strongly marked. The cause of this is so far unexplained.

2. The effect of blending different Wheats on the Water-absorbing Power of the resulting Flour.

Two wheat mixtures were taken, one a mixture of the following soft wheats, Hudson's Early Purple Straw, Steinwedel, and Federation, the other a strong-flour wheat mixture of Manitoba, Bobs, and Comeback. These wheats when reduced had the following water-absorbing powers and gluten contents.

	Water absorption, quarts per 200 lb.	Gluten.
Sample A (soft grain)	45·0	8·2
Sample B (hard grain)	50·8	13·8

These wheats were blended in three different proportions and the blends milled separately, when the following results were obtained :—

	Water absorption, quarts per 200 lb.	Calculated.	Gluten.
Original Sample A (soft)	45·0	...	8·2
Original Sample B (hard)	50 8	...	13·4
Blend 1 ($\frac{3}{4}$ A and $\frac{1}{4}$ B)	46·2	(46·7)	9·55
Blend 2 ($\frac{1}{2}$ A and $\frac{1}{2}$ B)	49·1	(47·9)	11·55
Blend 3 ($\frac{1}{4}$ A and $\frac{3}{4}$ B)	50·8	(49·2)	11·9

It is to be noticed that the water-absorbing power of the blend is on the whole somewhat higher than that calculated, and in this case the most favourable blend appears to be an equal mixture of the two. The blend formed by mixing $\frac{3}{4}$ of the strong-flour wheats with $\frac{1}{4}$ of weak-flour wheats has exactly the same water-absorbing power as the original strong-flour wheat.

3. Effect of mixing different Grades of Flour upon the Water-absorbing Power of the resulting blend.

Two samples of flour, one a fairly strong and the other a rather weak flour, were taken in order to ascertain what effect blending would have upon their water-absorbing power.

The weak flour A had a water-absorbing capacity of 48·9 quarts per 200 lb. flour, the strong flour B a water-absorbing capacity of 52·6. They were

blended together in different proportions, the blending being done by thoroughly mixing them in a flour-sifter provided with revolving arms, and repeatedly passing them through a dressing silk (No. 14) 136 meshes to the linear inch. The following table gives the rather peculiar result :—

	Water absorption, quarts per 200 lb.	Duplicate.	Calculated.
Original sample A (weak flour)	48·9	...	...
Original sample B (strong flour)	52·6	...	...
Blend No. 1 (¾ A and ¼ B)	51·0	50·0	(49·7)
Blend No. 2 (½ A and ½ B)	51·7	52 0	(50·7)
Blend No. 3 (¼ A and ¾ B)	53·6	53·7	(51·6)

This experiment was repeated with the two flours obtained in the previous wheat-blending experiment :—

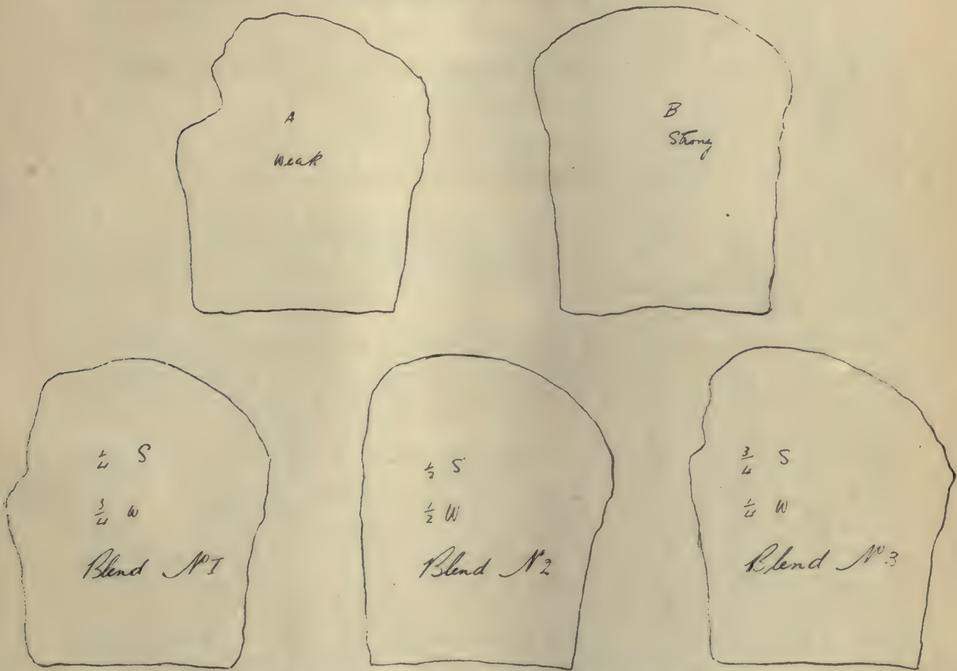
	Water absorption, quarts per 200 lb.	Calculated.	Gluten.
Original sample A (weak flour)	45·0	...	8·2
Original sample B (strong flour)	50·8	...	13·4
Blend No. 1 (¾ A and ¼ B)	46·5	(46·7)	9·6
Blend No. 2 (½ A and ½ B)	48·9	(47·9)	11·4
Blend No. 3 (¼ A and ¾ B)	51·8	(49·2)	12·1

In both these cases the water-absorbing power of the blend of ¾ strong and ¼ weak flour was not only considerably higher than the calculated, but distinctly higher than that of the original strong flour. The strong flours had a slightly yellowish tinge and the weak flours more nearly white. The increase of yellow in the blend both of wheat and flour increased apparently regularly with the increased proportion of strong flour, but the pecularity was noticed that the flour blends were of a better colour than the wheat blends, even when the flours were produced in the departmental mill. It would, therefore, appear more profitable to the baker to blend his flours than to use flour of one quality from a mixture of wheats, and that the addition of a small proportion of weak flour to his strong flour, so far from reducing the water-absorptive power of the latter, actually increases it.

In order to judge of the relative baking nature of these flours and blends, the flours obtained in the last experiment were baked into small loaves (160 grammes flour being taken in each instance) and the volume of each loaf calculated from its displacement of wheat. This amount is given in cubic centimetres :—

Loaf from 160 grammes.	Volume.
A (Velvet Ear)	542·6 cubic centimetres
B (Comeback)	579·3 ,,
Blend No. 1 (¾ A and ¼ B)	552·7 ,,
Blend No. 2 (½ A and ½ B	558·7 ,,
Blend No. 3 (¼ A and ¾ B)	583·0 ,,

Not only were the volumes of the strong-flour loaves larger, but the admixture of a small proportion of the weak flour gave a loaf of larger volume than was obtained from the strong flour used alone. The loaves from B and from



Outlines of loaves obtained in the baking tests. The loaves have been cut through the centre; figures are one-fourth actual size.

blend No. 3 were beautifully even in texture and in shape, the loaves from the weak flour and from the blends in which weak flour predominated being of inferior texture and exceedingly irregular in shape, which latter peculiarity may be seen from the attached outlines which represent the contour of the loaves cut through the centre.

Conference on Wheat Farming.

The Hon. the Minister of Agriculture has had under consideration a suggestion by Mr. R. W. Peacock, Manager of the Bathurst Experiment Farm, with respect to convening a conference of wheat growers and departmental experts to discuss questions affecting wheat production. Mr. Perry is of opinion that interchange of ideas by men of experience in all phases of wheat farming in various parts of the State, and discussion of matters of general interest will be of material benefit to the industry, and has accordingly decided to arrange for such a conference, during July next, at either Cowra, Bathurst, or Wagga, as may be found to be most convenient for all concerned.

Artesian Irrigation.

THE PRODUCTION AND COAGULATION OF DIFFUSIBLE COLLOIDS.

R. S. SYMMONDS, Chemist's Branch.

OF the many questions that arise when considering the injury done by artesian water to the soil and vegetation when used for irrigation purposes, there is none so important as that relating to the production of diffusible colloids by the alkali in the water.

During a visit to Coonamble, ample opportunity was given me to observe and take samples of soil rendered infertile by artesian water. Broadly speaking the soils in this district may be classified as (1) black clay, (2) brown loam, (3) gravelly sand, or "Monkey."

It was very noticeable that the injurious effects of the water on the black soil are slight when compared with the injury done to the brown soil and gravelly soil, and it is well to consider the following points in order to understand the nature of the injury referred to—(1) nature and depth of soil; (2) amount of lime and organic matter in the soil; (3) acidity or reaction of the soil; (4) quantity and nature of the saline substance in the water.

Some of these soils (the brown loam and gravelly sand) in a virgin state are generally acid to litmus paper, and are very friable, but under irrigation by bore-water, in a few years they become very hard and impervious to air and water. There can be little doubt that this difficulty is due to the colloid constituent of the soil being in a diffusible condition, which then fills the interspaces with a jelly-like substance, and thus immensely increases the resistance offered to the passage of water. This condition is brought about by (1) the carbonate of soda, which neutralizes the natural acidity and converts the clay and iron into diffusible colloids, and (2) the cementing action of the silicate of soda contained in the water, and that which is produced in the soil by the action of the soda on the finely-divided silica contained therein. In such a soil, roots quickly suffer for lack of air, the process of nitrification cannot go on, and what is even worse the nitrates already present in the soil before the puddling occurred may be lost by the process of denitrification. This in my opinion is the cause of so many failures where bore-water has been used for irrigation, and our thought and energy should be directed to supply nitrates, and to produce and maintain a friable condition of the soil, as plants cannot thrive on grindstones.

Now the first question for us to consider is, should we rely upon the uncertain microbe to produce the nitrates necessary for plant life, or would it not be better to rely on the certain method of producing nitrates by the direct application of nitric acid to the soil?

As regards the texture of the soil no amount of profitable cultivation will prevent the production of diffusible colloids when alkaline water is applied continuously. Nitric acid can now be manufactured on the spot from the nitrogen in the atmosphere for about £4 per ton,* and as this acid is exceptionally potent in coagulating diffusible colloids the outlook for the certain method is extremely hopeful.

The great resistance presented by some soils to the percolation of ordinary water is one of the difficulties with which all are familiar. The resistance is absolute when the soil contains a high percentage of diffusible colloids. In order to show the efficacy of acidulated water in penetrating a practically impervious soil, the following experiment was carried out, the result being very convincing. Soil, sample No. 6, table A, was selected for this experiment for the reason that its capillary power is exceedingly low. Two glass tubes, each 24 inches long, were closed at the lower end with muslin; they were then filled to a height of 14 inches with air-dried fine soil which had passed through a sieve containing 2,500 holes to the square inch. Both tubes containing the soil were allowed to drop on the bench from a height of 8 inches in order to uniformly consolidate the column of soil. Fig. 1 illustrates this experiment. Tube No. 1 was filled to the top with distilled water. Tube No. 2 was filled to the top with water acidulated with nitric acid. The photograph shows the amount of percolation in each tube in one hour. No. 1 shows $\frac{1}{4}$ inch, No. 2, 6 inches. The cloudiness above the level of the soil in No. 1 is due to the colloids diffusing in the distilled water.

Fig. 1.

Speaking generally, friable soils are acid to litmus paper, while stiff heavy soils are

* This is stated of other countries and other conditions. It has yet to be proved for Coonamble and other similar conditions.—H.C.L.A.

either neutral or alkaline. Good crops are grown on soils which are very strongly acid to litmus paper, and it does not necessarily follow that such soil will benefit by the application of lime. Indeed, during a recent visit to the Bathurst Experiment Farm, the Manager (Mr. R. W. Peacock) assured me that he obtained better yields from very strongly acid soil, and that a dressing of lime did not have any beneficial effect on the fertility or mechanical condition of this strongly acid soil. The friable nature of the soil on this farm is due to the fact that the colloids are in the coagulated condition, and are therefore not diffusible owing to the presence of a large amount of acid substances in the soil. In order to see the effect silicate of soda would have on this strongly acid soil, a small laboratory test was made in the following manner:—To one portion of a friable soil distilled water was added, another portion of the same soil was treated with a dilute solution of silicate of soda, both samples were evaporated on a water bath to the same consistency, rolled into balls, and allowed to dry. The texture of the sample treated with distilled water remained unchanged. The sample treated with silicate of soda became much darker in colour, which was due to the action of the alkali on the humus contained therein, and in two days set as hard and dense as Portland cement.

While on the question of acidity and friability of soil it may not be out of place to make a few remarks on this very important subject. From text-books we learn that acidity and sourness are practically synonymous terms, and the reddening of blue litmus paper when it is brought in contact with the wet soil is a sure indication of sourness, also that sourness is a cause of infertility which can be corrected by a dressing of lime. I am of the opinion that moderate acidity of the soil is essential to fertility, inasmuch as it plays an important part in maintaining a friable condition of the soil by coagulating the diffusible colloids and thereby producing compound particles which then lose their cementing power, thus rendering the soil pervious to air and water. Some soils undoubtedly benefit by the application of lime, and some extremely acid soils are very fertile.

The clay soils of the Dorrigo area are friable and fertile. They have a very strongly acid reaction, indeed the acid reaction is so strong that an attempt was made to determine the amount of acidity by titration. Fifty grammes of strongly acid soil were boiled in distilled water for ten minutes; the liquor was then filtered off into a litre flask. This operation was repeated eight times on the same 50 grammes of soil; the reaction of the soil was then taken to see if the acids were completely washed out. To my surprise the soil still gave a very strongly acid reaction; in fact, the blue litmus could not give a more pronounced red colour if placed in concentrated hydrochloric acid. The combined washings from the soil were then tested to ascertain how much, if any, of the acid had been washed out; it was found to be neutral. The experiment was repeated several times on that and other acid soils with the same result. Some time after the Dorrigo soils were examined, the Bureau of Soils, U.S.A., noted the same peculiarity, and I shall be pleased if this

problem is brought under the notice of the Director of the Bureau of Microbiology (Dr. Tidswell), as it is very probable that soil bacteria take an important part in producing this interesting condition.

Milton Whitney, Chief of the Bureau of Soils, U.S.A., when asked if he would consider the litmus paper test a sure indication that soil would respond to or require lime, replied, " No, I think it would be presumptive evidence that lime would be beneficial, but in the Bureau of Soils we have found that the reddening of blue litmus paper is not necessarily an indication of an acid soil, or one which needs lime. The reddening of litmus paper may be due entirely to the remarkable absorptive properties possessed by certain soils. You can take an acid soil, or you can take a neutral or slightly alkaline soil, and put litmus paper in contact with it, and it may redden it. But you can also take your blue litmus paper and absorbent cotton, wrap your litmus paper in the cotton and moisten it with perfectly pure boiled distilled water and leave it in contact, and in a short time the litmus paper will have turned red. This is due to the fact that blue litmus is a salt of an organic acid. The soil or the absorbent cotton has such an effect on the bases in the organic salt that they are withdrawn by the soil or cotton, leaving the acid in the paper, which thereby turns red. In other words, it splits up a chemical compound. This absorptive power is so remarkably strong in certain soils that they will actually break up silver nitrate and deposit silver in the soil as metallic flakes. The soil having absorbed the acid in contact with the silver has left the silver in its metallic state.

"The physical and chemical forces in thin liquid films in contact with solid surfaces so minute as the soil grains are of an entirely different order from those we get in our laboratory beakers, and we are learning a new chemistry through our study of the soil. We are learning of new chemical forces that we had never dreamed of in our laboratory work. The soil has a remarkable power to change or dispose of things, aside from the bacterial agencies we know. The minerals that are present in the soil are not only not themselves decomposing in the sense of disappearing, but as some decompose others actually form. We can supply salt solutions to our soils and produce minerals similar to the minerals existing in rocks—a thing which is difficult, if not impossible, to do in our laboratories.

" The litmus test is not a sure indication of the acidity of a soil. It is not even a sure indication of the need of lime, although it seems to be an indication that would make it reasonably safe to apply lime."

Professor King, when writing on the cause of injuries by alkalies, says: " When the soil water about the roots of plants or germinating seeds become sufficiently strong with salts in solution, the osmotic pressure is so modified that a discharge of the cell contents into the soil takes place to such an extent as to produce what is equivalent to wilting. The cells are not maintained sufficiently turgid to permit normal growth, or they may have the pressure so much lowered as to cause death. The case is like placing the

plump strawberry or currant in a strong solution of sugar, where it is observed to greatly shrink in volume. So, too, it is like placing meat under strong brine, and the use of sugar in preserves where there is so strong a solution about the products preserved that the germs of decay cannot thrive in them. This then is one of the modes by which the injurious effects of alkalies are produced, and it should be understood that it matters very little what substance may be in solution in the soil water so long as there is sufficient quantity to produce the osmotic shrinkage referred to. Everyone is familiar with the fact that too-concentrated fertilisers may produce death to the plant, and it may be by this action. Applying the principles to the alkali in the soil, it must be recalled that these compounds are all relatively very soluble in water, so that if only large quantities of water containing even small amounts of the salts are evaporated in contact with the roots of growing crops, the solution surrounding the soil grains may become too strong for good plant feeding, and even death may result."

On this fundamental principle of action, it is plain that the black as well as white alkalies fall into the same category, and this, too, no matter what may be their composition, origin, or geographic range. It is more than probable, if not even certain, that the action of some of these salts may be that of true poison; but the real nature of toxic effects is not as yet understood in any full sense.

Now, let us examine more closely the relation of the diffusible colloids produced by the saline substance in our artesian water to the principle laid down by Professor King, and we shall see that the friable nature and crumb-like texture of the original acid soil have been completely changed by the diffusible colloids which probably produce the osmotic shrinkage referred to. The soil is changed to a dense, impervious, hard mass when dry; indeed, a friable loam on Wingadee Station after a few years' treatment with artesian water became hard like solid sandstone, rendering ordinary tillage operations impossible.

The Wingadee Station garden has suffered considerably, most of the fruit trees were killed indirectly by the alkali; new trees were planted; those which have survived (oranges and mandarins) bear fruit not much larger than ordinary marbles. The soil is alkaline, and although the surface has been constantly stirred and manured to prevent caking, a hard-pan has formed about 10 inches from the surface. Similar soil (brown loam) a few feet away, and untouched by bore-water, has an acid reaction, and is very friable. Mr. M. A. Feehan informed me that there are large deposits of gypsum (copi) on Wingadee Station; in this connection he is fortunate, as gypsum, judiciously applied to the garden and orchard, will restore the soil to a friable and fertile condition.

In order to ascertain the amount of diffusible colloids produced in each type of soil where artesian water had been used for irrigation, the following test was made:—30 grammes of air-dried fine soil from each sample collected were briskly shaken in a cylinder containing 3 litres of water, and allowed

to stand undisturbed for seven days. Figs. 2, 3, and 4 illustrate the result. The cylinders and their contents will be explained in detail when dealing with the analytical data of the soils in question.

The following analyses of water from the various wells now under observation are by Mr. J. C. H. Mingaye:—

ANALYSES of Artesian Waters.

Grains per Imperial Gallon.

Name of Bore.	Sodium Carbonate (Na_2CO_3).	Potassium Carbonate (K_2CO_3).	Calcium Carbonate ($CaCO_3$).	Magnesium Carbonate ($MgCO_3$).	Sodium Chloride (NaCl).	Sodium Sulphate (Na_2SO_4).	Iron Oxide and Alumina (Al_2O_3 and Fe_2O_3.)	Silica (SiO_2).
Yuma	32·531	trace	0·749	trace	3·811	1·643	0·112	1·960
Wingadee No. 4	47·411	trace	0·750	0·294	7·464	0·224	trace	1·624
Otterndorf ...	51·407	trace	0·875	0·199	20·679	......	trace	1·274
Darnley Chase...	33·967	·142	0·887	0·168	6·290	1·705	trace	1·652
Quambone No. 1	41·064	trace	0·800	0·250	7·315	......	trace	1·288
Cherrigorang ...	42·813	0·175	0·850	0·357	7·156	.....	trace	1·316

The tabulated results of the chemical and mechanical analysis of the soils dealt with will be found in Tables A and B.

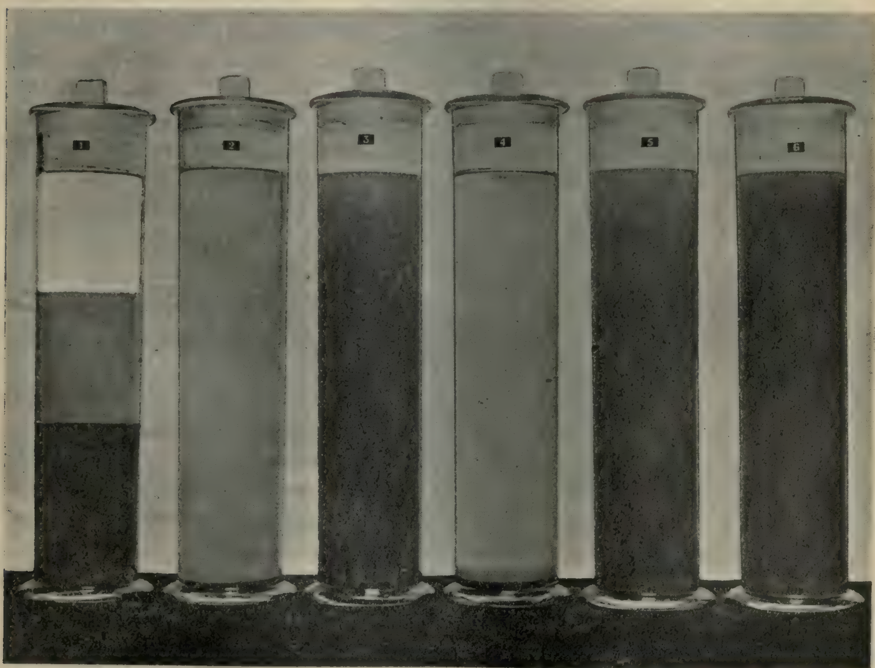


Fig. 2.

No. 1 is from Mr. J. Lander's property, Yuma, and has been under irrigation for some time; it is a black, heavy loam with a very faintly alkaline reaction, good water capacity, and contains a fair amount of organic matter, practically the same amount as the unirrigated soil, though the nitrogen is low, which is due to the presence of the alkali and the process of denitrification. It is well provided with mineral plant-food, and is in a fairly good mechanical condition at present, which is due to the presence of a large amount of lime. The capillary power is very poor and indicates the presence of diffusible colloids, which are beginning to form in this soil and can be clearly seen in cylinder No. 1, where they have separated into three distinct layers.

Comparatively speaking, the water from this bore is fairly low in carbonate of soda; it contains only 32·531 grains per gallon; the carbonates of lime and potash, both of which are excellent fertilisers, are exceptionally low.

No. 2 is also from Yuma, and is the same type of soil as No. 1, but unirrigated. The reaction is neutral. It contains a fair amount of organic matter and nitrogen, with a good water-capacity. The capillary power is good, owing to its friable texture, and indicates the absence of diffusible colloids, which is supported by the test in cylinder No. 2, where the colloids, being in a coagulated condition, have completely settled.

Nos. 3 and 5 have a very faintly alkaline reaction, and are samples collected from the cultivation paddocks on Wingadee, where the soil is in a very bad mechanical condition, and they show in a very striking manner the injurious effects of the artesian water on the brown loam. When they are compared with virgin soil (No. 4) from the same vicinity it will be seen that the capillary power is very low; the water-capacity, amount of organic matter and nitrogen, have also been considerably reduced. They are not so well provided with lime as the black soils, which partly accounts for their hard condition, but they are well provided with potash and phosphoric acid. Cylinders Nos. 3 and 5 show the presence of a very large amount of diffusible colloids in these soils.

The water from this bore before it was deepened contained a rather large amount of carbonate of soda (49·411 grains per gallon), practically no potash, and a very small amount of lime. After the bore was deepened the water from an agricultural point of view improved very considerably, as it now contains less than half the amount of carbonate of soda and produces about £1,000 worth of potash and £300 worth of lime per annum, both of which are excellent plant-foods. The value of the water from this bore, for irrigation purposes, would be greatly increased by shutting off the water from the higher levels which contains the large amount of soda.

No. 4 is a virgin soil from Wingadee; it is similar soil to Nos. 3 and 5, and has not been touched by bore water. It has a neutral reaction and may be classified as a good fertile soil of good mechanical condition, well provided with mineral plant-food and nitrogen. Cylinder No. 4 shows that the

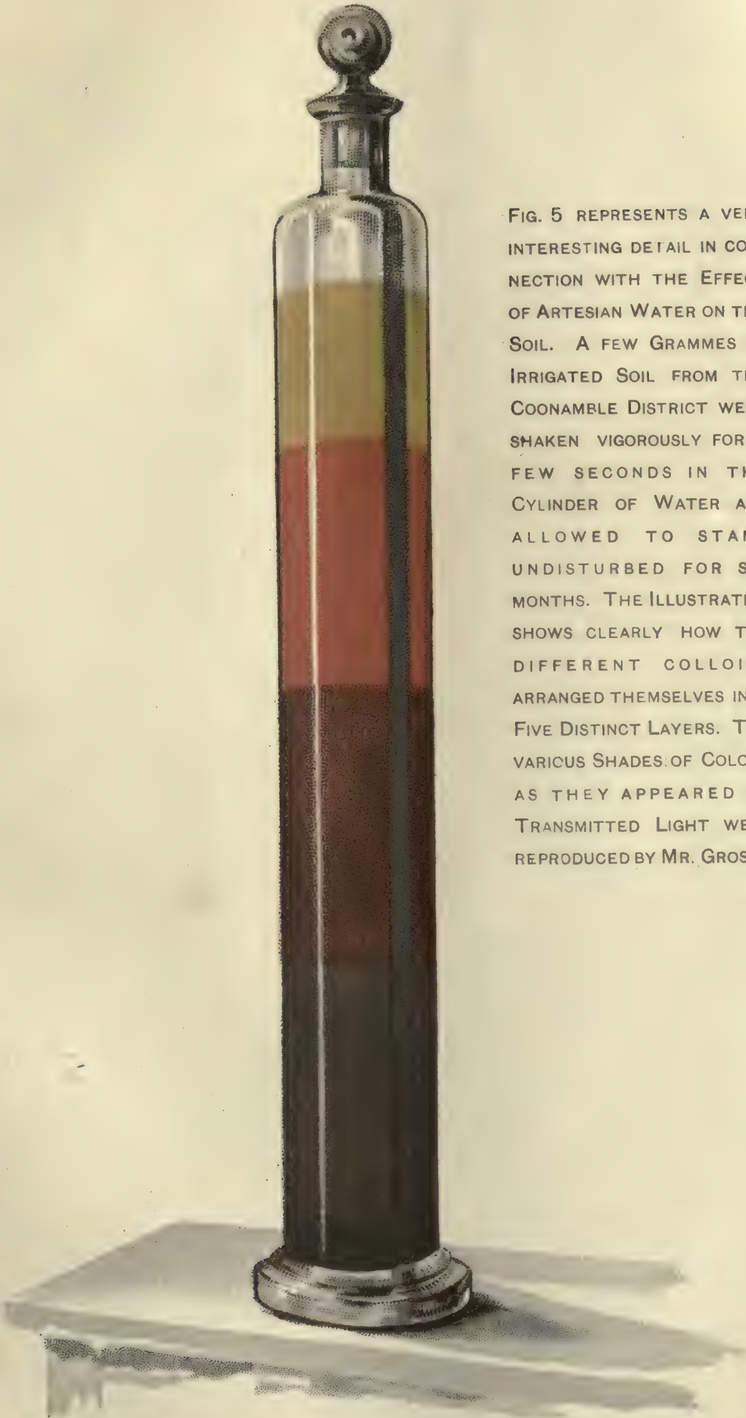


FIG. 5 REPRESENTS A VERY INTERESTING DETAIL IN CONNECTION WITH THE EFFECT OF ARTESIAN WATER ON THE SOIL. A FEW GRAMMES OF IRRIGATED SOIL FROM THE COONAMBLE DISTRICT WERE SHAKEN VIGOROUSLY FOR A FEW SECONDS IN THE CYLINDER OF WATER AND ALLOWED TO STAND UNDISTURBED FOR SIX MONTHS. THE ILLUSTRATION SHOWS CLEARLY HOW THE DIFFERENT COLLOIDS ARRANGED THEMSELVES INTO FIVE DISTINCT LAYERS. THE VARICUS SHADES OF COLOUR AS THEY APPEARED BY TRANSMITTED LIGHT WERE REPRODUCED BY MR. GROSSE.

THE EFFECTS OF CERTAIN ARTESIAN WATER ON THE SOIL.

colloids in this soil are in a coagulated condition, and, therefore, have settled completely.

No. 6 is a very interesting sample from Otterndorf. The soil is a heavy loam of a brown colour, faintly alkaline reaction, and has been under irrigation for five years. It is in a very bad condition, which is undoubtedly due to the presence of a large amount of diffusible colloids and the resulting extremely low capillarity. This soil is known locally as a sterilised soil—indeed no better name could be applied to it. It is well provided with mineral plant-food, and on comparing the figures obtained in the mechanical analysis with those obtained from a very fertile black soil about 200 yards distant (No. 7), the difference is not very remarkable. The chemical analysis, however, discloses the fact that the black soil contains considerably more lime than the brown soil. Cylinder No. 6 illustrates in a very striking manner the large amount of diffusible colloids in this brown soil.

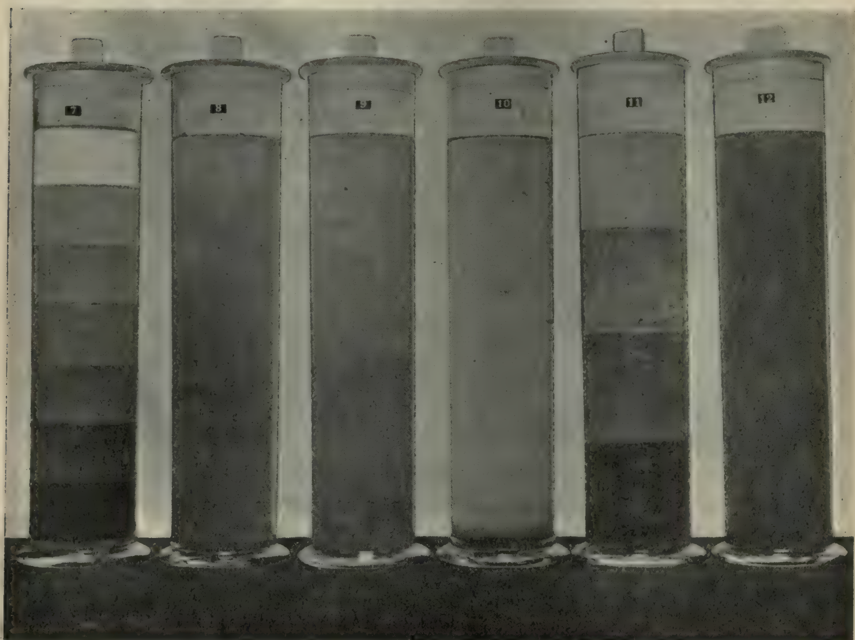


Fig. 3.

No. 7, also from Otterndorf, and has been irrigated for five years. The soil is a black, heavy loam of a mechanical condition, which is usually associated with a power to retain moisture, and it will be seen that its water-holding capacity is high ; it has an alkaline reaction, and is at the present time producing excellent crops of lucerne, which is probably due to the presence of a fairly large amount of lime. The presence of diffusible colloids

in this soil is indicated by the very low capillarity, and they are clearly seen in cylinder No. 7, where they have settled into seven distinct layers, which is very singular when we recall the fact that this soil has been irrigated for five years. The cylinder was shaken vigorously a second time, and allowed to stand undisturbed for a week, the colloids again arranged themselves into seven distinct layers. The water from this bore contains rather a large amount of carbonate of soda, practically no potash, and very little lime; it contains, however, nearly 21 grains of salt per gallon. Salt possesses the peculiar power of coagulating colloids, which fact, coupled with the presence of a high percentage of lime, possibly explains why Mr. Parkinson is successful with bore-water for a longer period than others.

No. 8 is virgin black soil from Otterndorf, and is very similar to the virgin soil from Yuma; the capillary power is lower, and indicates diffusible colloids, which are clearly seen in cylinder No. 8, and prove that a neutral soil favours the production of diffusible colloids.

No. 9 is a brown loam from Darnley Chase. The soil is at present in a fairly good mechanical condition, good capillary power, and is well provided with mineral plant-food. It is, however, deficient in humus (vegetable matter), in consequence of which its capacity for holding water is very low. It has a neutral reaction, and it would thus appear that the quantity of alkaline water applied has only been sufficient to neutralize the natural acidity of this soil; at the same time cylinder No. 9 shows that the colloids are just showing signs of diffusion. Mr. F. Stewart obtained very good results in his garden for the first year when using bore-water; others had a similar experience, which was very misleading, as this type of soil in a few years, under the influence of alkaline water, became as hard as sandstone. Green manuring and the judicious application of gypsum would prevent this undesirable condition.

No. 10 is a brown sandy loam from Quambone garden, which is successfully irrigated by creek water. The soil is in excellent mechanical condition, very friable, with a high capillary power. It is deficient in organic matter, consequently the nitrogen content and water capacity are low. It is fairly well applied with lime and phosphates, though deficient in potash; its reaction is neutral, and owing to the absence of alkaline carbonate of soda the colloids are in a coagulated condition, and have settled completely in cylinder No. 10.

Orange, mandarin, and lemon trees thrive well on this soil when irrigated with creek water; indeed, the Quambone oranges and trees have a world-wide reputation. Some of these trees were planted forty-five years ago; at the present time they are 35 feet high, and are without a blemish of any kind. Peach, nectarine, and apricot trees do not thrive on this soil; they all died in sixteen months. Plum trees have survived, however; they are now four years old, and are expected to bear fruit next year. A few years ago artesian water was used on a portion of this garden; it killed many of the fruit trees, and the soil became very hard.—*See Bulletin No.* 12.

Nos. 11 and 13 came from the vicinity of Quambone Bore No. 3 and are practically alike chemically and physically, excepting the lime content of No. 13, which is lower, consequently the capillary power is less. They are dark-coloured, faintly alkaline loams of low water capacity, are very hard, and show the injurious effects of the alkali, which can be seen in cylinders Nos. 11 and 13. The following very interesting particulars of this soil under irrigation were given me by Mr. J. Broatch, whose experience corroborates the experience of others who have used artesian water on this type of soil.

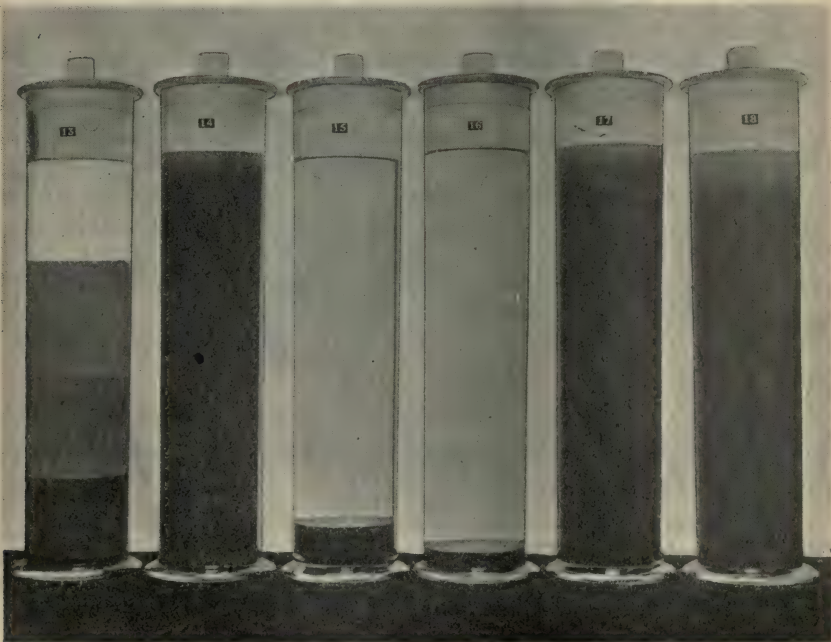


Fig. 4.

The first year under irrigation lucerne was grown with fair success. Second year the lucerne crop was indifferent. Third year, with a rainfall of 26 inches, the lucerne was a failure. Fourth year the lucerne died right out and all the roots rotted. Fifth year, fallow. Sixth year, the land was ploughed and sown with lucerne (Hunter River and Turkestan seed), which was a complete failure.

No. 12 sample is in a very bad condition, and was selected from a spot near No. 1 bore, Quambone. It is very hard when dry, rendering ordinary tillage operations unprofitable; indeed, eight ploughshares were broken in ploughing a small plot 60 feet by 30 feet. The soil is a reddish brown loam, fairly well supplied with mineral plant-food and of good capillary power. The water capacity is very low, which is due to the low humus

content and the presence of alkaline carbonates which dissolve out the organic matter. A good method to increase the water-holding power of this soil is by increasing the proportion of humus. For garden purposes, or on a small scale, this may be done by digging or ploughing in heavy dressings of farmyard manure. In the field the same result may be accomplished by the ploughing in of green crops, which on their decay add greatly to the store of humus in the soil. Preference is usually given to leguminous crops for this purpose, as the soil is then enriched with nitrogen. Cylinder No. 12 shows the large amount of diffusible colloids in this soil.

Nos. 14, 15, 16, and 17 are typical soils from the proposed site for an experiment farm at Coonamble. They are all virgin acid soils, and, with the exception of No. 17, are all low in humus (organic matter), consequently their nitrogen content and water capacity are rather low.

Cylinders Nos. 14, 15, and 16 are of particular interest and show in a very striking manner the potency of nitric acid and of lime-water in coagulating the diffusible colloids produced in the soil by artesian water when used for irrigation purposes. These three cylinders each contain 30 grammes of a soil which has been rendered infertile by bore-water. Three litres of water having been added to each cylinder, they were shaken vigorously for a few seconds. No. 14 shows the large amount of diffusible colloids present in this soil. This cylinder had been standing undisturbed for seven days when the photograph was taken.

To cylinder No. 15 a few drops of nitric acid were added which had the effect of coagulating and precipitating the colloids in 30 minutes, leaving the supernatant liquor transparent as distilled water.

The contents of cylinder No. 16 were treated with a small quantity of lime water, which caused the colloids to coagulate and settle in 40 minutes. The supernatant liquor in this case contained finely divided particles (not colloids) which settled in 48 hours.

Another very interesting feature in connection with our artesian basin—perhaps it would be more correct to say our series of superimposed artesian basins—was brought under my notice by Mr. K. Stewart, who is sinking the new bore for the Town of Coonamble. It appears that immediately above and below each water-bearing stratum there is a layer about 3 feet thick of very tough, dense, sticky clay which presents considerable resistance to the progress of the drill owing to its tenacious nature. This, in the writer's opinion, is the true impervious stratum which prevents the escape of the water upward and downward, and has been produced by the alkali in the water acting on the clay and iron, converting them into diffusible colloids. The colloids thus produced are then squeezed together by the great pressure of the water until they become absolutely impervious. Cylinder No. 17 contains 30 grammes of clay from a layer above a water-bearing stratum, and cylinder No. 18 the same amount of clay from a layer below. In each case nearly all the substance is in a diffusible condition.

Table A.

Analysis of Soils from the Coonamble District.

No.	Distinguishing Mark.	Colour.	Reaction.	Water Capacity.	Capillary Power.	Moisture.	Volatile.	Nitrogen.	Fertilising Substances. Soluble in Hot Hydrochloric Acid, sp. gr. 1·1. Lime (CaO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).
				%	%	%	%	%	%	%	%
1	Yuma, Irrigated	Black	Very faintly alkaline...	51·5	1·6	5·85	6·57	·098	·627	·499	·136
2	,, Virgin...	,, ...	Neutral...	46·0	6·2	6 05	6·53	·105	·640	·404	·115
3	Wingadee, Irrigated..	Brown	Very faintly alkaline...	34·5	1·5	3·29	3·95	·084	·317	·367	·108
4	,, Virgin	,, ...	Neutral...	43·0	3·5	4·54	5·90	·126	·370	·458	·096
5	,, Irrigated...	,, ...	Very faintly alkaline...	33·0	1·0	4·25	4·35	·084	·327	·372	·120
6	Otterndorf ,, ...	,, ...	Faintly alkaline ...	49·0	0·2	5·20	5·45	·091	·444	·219	·117
7	,, ,, ...	Black	Alkaline	62·0	0·7	7·25	5·40	·098	·742	·374	·152
8	,, Virgin	,, ...	Neutral...	51·0	2·2	5·45	5·14	·119	·420	·287	·090
9	Darnley Chase, Irrigated	Brown	,, ...	24·0	5·5	1·77	2·64	·098	·250	·213	·141
10	Quambone, Garden	,, ...	,, ...	24·0	10 0	0 77	1·92	·084	·222	·043	·109
11	,, Irrigated	Dark	Faintly alkaline ...	33 0	4·0	2·41	4·17	·112	·570	·291	·166
12	,, ,, ...	Reddish brown..	,, ...	27·5	5·0	1·32	2·92	·084	·235	·079	·129
13	,, ,, ...	Dark	,, ...	33·0	2 5	1·59	2·90	·112	·221	·235	·166
14	Experiment Farm Site, Virgin ...	Brown	Acid	24·0	7·0	1·45	3·02	·056	·180	·128	·128
15	,, ,, ,, ...	,, ...	,, ...	29·0	10·0	0·86	2·34	·056	·120	·043	·104
16	,, ,, ,, ...	,, ...	,, ...	24·0	10·0	1·25	3·00	·056	·140	·128	·103
17	,, ,, ,, ...	Black	Very faintly acid ...	53·0	2·5	5·95	8·60	·105	·624	·233	·130

Table B.

MECHANICAL ANALYSIS.

Number.	Nature of Soil.	Coarse Gravel.	Fine Gravel.	Sand.	Clay.
No.		per cent.	per cent.	per cent.	per cent.
1 (1) ...	Heavy loam ...	0·80	11·40	18·00	69.80
2 (1A) ...	,, ...	0·20	15·14	20·30	64·36
3 (2) ...	Loam	0·14	21·66	28·30	49·90
4 (2A) ...	,, ...	0·32	17·46	29·00	53·22
5 (2B) ...	,, ...	0·40	22·20	31 00	46·40
6 (3) ...	Heavy loam ...	0·20	9·00	22·30	68·50
7 (3B) ...	,, ...	0·14	5·26	15·00	79·60
8 (3C ...	,, ...	none.	7·74	21·70	70·56
9 (4) ...	Loam	0·20	14·14	48·00	37·66
10 (5) ...	Sandy loam ...	0·20	19·84	61·00	18·96
11 (6) ...	Loam	0·34	10·20	53·00	36·46
12 (7) ...	,, ...	0·14	9·26	56·70	33·90
13 (8) ...	,, ...	1·60	9·80	56·70	31·90
14 (1) ...	,;	none.	16·54	36·66	46·80
15 (2) ...	Gravelly loam ...	none.	46·60	39·70	13·70
16 (3) ...	Loam	0·20	22·80	35·00	42·00
17 (4) ...	Clay	none.	11·74	10·30	77·96

EXPERIMENTS WITH ELECTRICITY.

MR. ALEX. C. BENNETT, of Dorne, writes :—"Being interested in a paragraph which appeared in the *Agricultural Gazette* on electricity as applied to seeds, I did a little experimenting with a small dry battery, as follows :—Measuring equal quantities of lettuce-seed from the same packet, I prepared a small bed and divided it with a trench in the middle. On one side I planted the seed in its natural state, and on the other seed which I had previously electrified —by placing on a damp cloth on the plate attached to the battery. The time I gave was four minutes, applied at medium strength.

"The result so far has been very satisfactory. The electrified seed germinated well and beat the non-electrified by seventy-two hours. The plants look strong and healthy, and there is every indication that they will maintain the lead they have gained.

"Peas treated by electricity have germinated from twenty-four to forty-eight hours sooner than those not treated.

"I am following the experiments up and applying electricity to young plants by means of a damp cloth laid on the top of them, and causing the current to pass through them by means of this conductor."

Pera Bore Orchard.

W. J. ALLEN.

THE artesian well which supplies the water for irrigating the orchard and different crops was sunk in the year 1890 for the convenience of the public and for travelling stock, this route being largely used for travelling sheep and cattle which are being moved from one station to another, either for the purpose of restocking or for feed, while thousands are intended for the Sydney market. The well is 12 miles from Bourke, and adjoins the Wanaaring road, which reaches from Bourke (the terminus of the railway line) to Wanaaring, and thence to the Never Never Land; and as this road is one of the main tracks for camel and bullock teams bringing in wool, for, perhaps, hundreds of miles back in the Never Never country to the railway at Bourke, and returning again laden with supplies to the stations and towns in the interior, it is not an uncommon occurrence to see these large teams encamped for the night at this

Fig. 1.—Washington Navel Orange Tree in bloom. 10 years old. Pera Bore Orchard.

watering-place, where they are glad to avail themselves of the plentiful supply of water which they are sure to find here in the hottest seasons. The mail coach which delivers the letters at the farm makes only one trip per week into the back country, so that unless it is found necessary to visit Bourke between mail days, mails only reach this Government Orchard once a week. However, we are connected with Bourke by telephone, which is a great convenience in this out-of-the way place.

Pera, with its green orange and lemon trees, laden with beautiful golden fruit, its crops of lucerne, sorghums, corn, and grasses of varying colours, is indeed an oasis in the desert, and in the summertime is a welcome sight to tired and dusty travellers who have, perhaps, been jolting along in the coach for several days and nights, with scarcely a break in the monotony of grey mother earth beyond that afforded by the Giji, Mulga, and a few other trees, indigenous to that part of Australia. These travellers frequently call at the orchard and buy a stock of fruit with which to quench their thirst whilst journeying into the interior.

The first planting consisted of a good many prunes, apricots, peaches, pears, and figs, and later some vines and citrus trees; but after cultivating these for a few years it was found that whilst the citrus trees were producing some of the best fruits of their kind, that of the deciduous trees were not up to the standard. It was, therefore, decided to uproot the pears, peaches, prunes and apricots, and to plant more oranges; but it was not until trees planted on orange stock commenced to bear that we realised that we could produce a very superior flavoured fruit which could hold its own with the very best grown in any part of the world.

The soil is red in colour, and is very deficient in vegetable matter. We have tried to improve it in this respect by liberal applications of sheep and stable manure, as also by growing crops of peas, rape, &c., among the trees, and turning these under in the spring. We have succeeded in growing a few good crops, but have had great difficulty in turning them under, owing to the fact that the land dries out so quickly and sets like cement. For instance, this season we had good rains in August, and early in September the land was too wet to work, and in less than three weeks it was so hard that it took three horses to pull a single-furrow 10-inch plough. I have had experience in working soils in Canada, California, as well as in all parts of this State and Victoria; but I have never had anything so hard to work as this land, and yet there is always a day or two after each irrigation, or heavy rainfall, during which it is easily worked, but the trouble is that one cannot afford to keep sufficient horses and men to work it up so quickly. It is not so bad after an irrigation, as with the present head of water (about one hundred thousand gallons per diem) we can only cover a small area each day, which can easily be worked up properly as soon as it is dry enough. We do not like to irrigate more often than is absolutely necessary as the more of this water we apply to the land the harder it sets, and while we can produce good crops with the artesian water, we find that the better we can keep the soil worked up the less water the trees require and the better they do. It

Fig. 2.—Crop of rape for green manure. Pera Bore Orchard.

is always noticed that the trees do better in summer after a heavy rain than after an irrigation, but unfortunately in the dry country it is only on rare occasions that the falls are sufficiently heavy to take the place of an irrigation.

After each watering we endeavour to work the soil up to a good depth with a 6 foot double disc and cultivator, while the soil underneath the trees is loosened up with a fork hoe. We find it necessary to use three horses in this orchard to pull the same plough or cultivator which in any of our other orchards requires only two.

We have land which has been irrigated continuously since 1895, and is still producing good crops of fruit. As previously explained, the soil is inclined to set very hard after it has been irrigated for years, and it therefore requires the very best attention to keep the trees in a healthy growing condition; but we do not mind bestowing this little extra work as there is an unlimited demand for this fruit, which brings the highest prices not only in Australia but in America and Europe where it has been put on the market, and where, in addition to top prices, it called forth the highest encomiums. Unfortunately in this part of the country the soil is patchy, and in several places in the orchard there are hard spots where the trees never do well and are continually dying, so that it will be seen that fruit-growing in such soil in our back country has its disadvantages as well as its advantages.

Varieties.

We find that the Mediterranean Sweets do exceptionally well. The trees are low and very spreading and carry good crops of high quality fruit which finds just as ready sale as the Washington Navels. We have never experienced any difficulty in finding purchasers for this variety at from 12s. 6d. to 15s. per case, and one tree which we have named the Improved Mediterranean Sweet produces fruit which we are selling at 3s. per dozen and by the case 25s. The improved tree is growing amongst the others, but is far superior in flavour to anything of its kind I have ever tasted either in Australia or America. These trees are worked on orange stock and have developed into very fine trees, some of the tops of which are 60 feet in circumference. I do not know of any other part of this State at present where this variety can be grown at a profit. In the orange-growing district in the Cumberland County this tree is quite a dwarf and growers have never considered it a profitable one to cultivate.

Mediterranean Sweet.

This fruit is medium size; pulp of fine texture, rather solid, with few seeds. Ripens September and October. The tree is of low, spreading habit, thornless, producing regular crops, but does not overbear here as in America. There are very few districts where they can be profitably grown. Average size $2\frac{5}{8}$ inches diameter by $2\frac{7}{8}$ inches in length.

Blood Orange.

Fruit medium sized, about $2\frac{3}{4}$ inches, streaked and mottled with red, skin dark orange coloured, flesh fine, flavour good. Ripening about September. This variety does well here—crops early and regularly, and is well liked by the public. The trees were supplied as Joppas and are almost thornless.

Joppa.

Fruit medium sized, $2\frac{5}{8}$ inches x $2\frac{3}{4}$ inches; flesh, fine grained, juicy; rich flavour, few seeds. Tree upright, spreading, regular cropper. Is well worth growing in this district.

Siletta.

Fruit medium sized, but up to the present this variety has not proved a success in this district.

Holdfast.

A coarse and poor flavoured variety which hangs well, but is not worth growing in this district. We have reworked the trees to Washington Navels.

Homosassa.

Fruit round or slightly oblate; medium to large in size, $2\frac{3}{4}$ inches to $3\frac{1}{4}$ inches. Flesh rather coarse grained; rich flavour, many seeds. A fairly good early orange, but not worth planting extensively. A Florida seedling raised at Homosassa, Fla., U.S.A.

Late Valencia.

Hart's Tardiff. Fruit medium sized, pale yellow. Flesh, rich deep yellow, sprightly and crisp. Tree a strong grower, slightly thorny. Ripens late and is not at its best until November and December, but will hang much later if required. Is, however, inclined to turn green again if kept too long on the tree. Should be worked on orange stock to obtain the best flavoured fruit. One of the best for export, and does well in many parts of the State.

Washington Navel.

One of the best varieties grown. Fruit rounded, tapering towards the apex. Large sized, $3\frac{1}{4}$ inches to $3\frac{5}{8}$ inches. Sections well defined, about ten in number. Flesh a little coarse at times; juicy and rich in flavour. The best navels from this orchard have sold readily at 20s. per case. I have seen the tree which the Department of Agriculture, Washington, sent to Mrs. Tibbitts, of Riverside, California, and from this tree or its progeny buds were obtained for the working of nursery stock for the planting of the large Washington Navel orchards of California and other countries.

Lisbon Lemons.

These do exceedingly well when worked on the orange stock, and the fruit stands exporting well. Lemons from this orchard were sold in Vancouver at three dollars and a half per case, which is equal to about 14s. 7d. per case.

Emperor Mandarin.

These also do exceptionally well here and produce very large, highly-flavoured fruit which ripens early, but will not hang very late.

Beauty of Glen Retreat.

These trees carry heavy crops of fruit, but a large proportion of it splits. It is inclined to be rather acid and I could not recommend the planting of this variety in the interior.

Pruning.

We keep the trees rather open in the centre, but allow the branches to spread and hang close to the ground, which tends to keep the ground from drying out and shelters the trunks of the trees, while the lower limbs produce some of the finest fruit. This form of tree does not permit of our working very close to the trunks with the horse implements we have, and in consequence makes extra hand work; but this, I consider, is more than compensated for by the tree being in better condition to carry an extra crop of fruit. I am also inclined to think that in this climate, by having the ground so shaded, that it saves the cost of an irrigation, and this alone is a great consideration as our water supply is limited, and the less water we have to use to keep the trees in condition the better for both land and fruit.

Diseases.

Occasionally we have found live scale in nursery stock when the trees have come from the nurserymen; but on the whole we have had very little

trouble with pests excepting the grasshoppers, and have not had to do much spraying or fumigating for scale insects. Our fruit is in consequence absolutely clean and bright and fit to put on any market. It is true that a few cases of it which residents of Bourke have purchased for the purpose of sending to Tasmania have been destroyed by the authorities there, but it could never have been because the fruit was diseased as we have never sent a case of diseased fruit out of this orchard.

Packing.

The oranges are run through a grader before packing and after being so graded are neatly wrapped and packed evenly in cases with great care. This makes a good strong case which will stand considerable knocking about with the minimum risk of damaging the fruit—a great consideration when cases have to travel 500 miles by rail and have to be handled several times by people who imagine they are handling a commodity which requires severe bumping in order that it may arrive at its destination in good order. I wonder how long our growers will have to put with such injustice. A man may pack his fruit well, handle it like eggs, but the moment it is out of his hands it is bumped around and handled as though its only chance of reaching its destination in good condition is by shaking it up well and knocking it about—thus in a day or two the whole of a year's work is jeopardised or lost through rough handling in transit.

While most of our energies at Pera Bore are devoted to fruitgrowing we are trying to find out something about the best grasses, sorghums, corns, and hay crops to grow in this hot country—both with and without irrigation.

Other Experimental Work—Grasses.

Three years ago we sowed about one-eighth of an acre of Rhodes grass and gave it one watering after which some of the seed came up and that was the only application of water it ever had.

Fig. 3.—Rhodes grass, Pera Bore Farm, immediately after planting in rows 4 feet apart.

Fortunately though, we had good rains the following January which not only did a lot of good to the plants which were up but also brought up more seed. These plants grew and covered more than half of the area sown and produced quite a lot of good feed for the past three years, during which time they have only had the natural rainfall to keep them alive. Paspalum was sown side by side but did not live through the second summer. Mitchell Grass was planted but did not do well either.

Feeling confident that Rhodes is the best grass for the back country with which up to the present we have experimented, we ploughed up a portion of the original plot, and used the roots for planting about 3 acres, placing them about 4 feet x 4 feet apart. The ground was prepared by ploughing it to a good depth and working it down fine—then during the first week in September furrows were drawn and the roots planted by making holes with a bar in the bottom of the furrow, into which the roots of the grass were placed and the hole well filled with damp earth. The cultivator will be run between the rows occasionally and in a year hence or perhaps earlier I will take other photographs and have them published together with notes as to how the roots have taken. These are planted in dry red land which is not to receive any irrigating. As a matter of fact we could not water the land at present if we wished as the water is not laid on this area yet. Side by side with this, a little over an acre was sown with the seed, towards the latter part of August, but up to the first of October none of this was showing above the ground. Immediately after a thunderstorm last February I had about a quarter of an acre sown, and some of the seed started in the hollows where the water lodged, but on the higher portions none of it started. I will make a further report on this latter when it can be seen if any more of the seed started during the spring.

Fig. 4.—Assorted grasses, Pera Bore Farm, planted in rows and irrigated

In addition to the above grasses we have planted a few hundred roots of Andropogen sericeus—Blue grass, Phalaris commutata, Paspalum dilitatum, Eragrostis pilosa—Weeping or Love grass, Astrebla sp., Mitchell grasses. These latter to be grown under irrigation. More grasses will be planted during the coming summer, and we hope eventually to have from 8 to 10 acres along the Wanaaring-road, where it can easily be seen by passers by.

Hay Crops.

We have about 20 acres of hay crop in this year, some of which has been irrigated and some not, and, up to the present, the irrigated shows but little advantage over the unirrigated. The ground not being even in quality makes it patchy in places, and therefore, while some of it in the good red soil will go about 3 tons to the acre, we have small plots on the grey soil which will go less than a ton. I think, however, that had we been able to give the crop on the grey soil a watering about a month ago these plots would have picked up, but we have had to pull down the old fluming

Fig. 5.—Wheat, not irrigated, at Pera Bore Farm.

and erect casing to take its place, and were in consequence unable to make use of the water, excepting for the one watering early in the season. We expect to have between thirty and forty tons of hay from this 20 acres. Included in the hay crop is a splendid plot of Skinless barley which was sown late, and which it is anticipated will yield about 30 bushels of grain to the acre. This we will allow to ripen and after threshing and crushing it, will make use of it for horse feed.

Fig. 6.—Wheat (1, irrigated; 4, unirrigated); 2, Skinless Barley; 3, Cape Barley.

Lucerne.

Last autumn we sowed about 3 acres of lucerne and cut it for the first time about the middle of September. We had a fairly good stand but some mustard grew among the lucerne which rather spoilt the first crop for hay; but from now on we expect to cut the crop every six weeks, provided we have sufficient water to irrigate it regularly; but I fear that we may have to miss one or two waterings during the summer months as the trees will then require all the available supply.

Maize.

The earlier sown corn which was planted about the middle of September was well up by the end of the month, and we hope to harvest this crop without giving it more than one application of water which will be made about the time it is tasselling.

Citrus Crop.

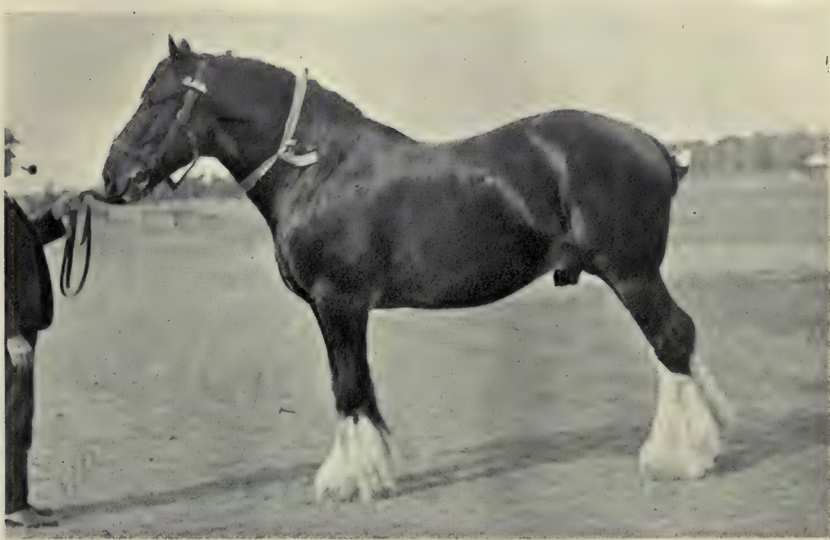
We have never had such a promise for a crop of citrus fruits. Every tree is laden with blossoms, and, unless something unforeseen happens, we should harvest between two and three thousand cases this coming season. Many of the young trees which have not yet carried an orange will carry a few this year, and all the older trees should hold heavy crops.

Planting Fruit-trees.

At the Woburn Experimental Fruit Farm (England), the director, Mr. S. A. Pickering, has carried out some experiments in the planting out of fruit-trees, the results of which are rather startling. The purpose of the experiments was to determine whether it is right, in planting out fruit-trees, to dig a broad shallow hole and evenly spread the roots out all around the tree, or to make a small hole, double up the roots, and stick the tree in; then throw in the soil and ram it as hard as if one were putting in a gate-post.

The experiments were carried out, not only at Woburn, where the Duke of Bedford carries out much valuable and exact experiment work, but at Harpenden, Bedford, various places in Cambridgeshire, and in Devonshire. Fifty-nine per cent. of the sets showed in favour of ramming, 27 per cent. showed no difference (*i.e.*, all the elaborate detail of the ordinary way of planting was simply a waste of time), and only 14 per cent. were against ramming.

Mr. E. J. Russell, writing in *Nature*, says:—"It makes no difference by what criterion the trees are judged; planting in this new way gives better results than planting in the orthodox fashion";—which, of course, remains to be seen. But in the transplantation of trees, the orchardist in Great Britain can successfully do things that would mean utter failure in New South Wales. Generally speaking, the trees used for planting out are of several years' growth, and are great lanky trees. The moisture of soil and air, however, seems to help them to recover and establish themselves. In beautifying the grounds of the Franco-British Exhibition, all sorts of deciduous ornamental trees, up to 3 or 4 inches diameter and 20 feet in height, were set out in small holes sunk in stiff clay, and it was amazing to observe how they flourished.



Clydesdale stallion, Plucky Willie.
[Imported from New Zealand; descended from Drew's Prince of Wales (673)]
Reserve Champion R. A. Show, Sydney, 1908. First and Champion R. A. Show, Sydney, 1909.

Clydesdale mare, Norah, with foal by Plucky Willie.

Hawkesbury Agricultural College.

Crossbred Clydesdale x Suffolk Punch mare, Florrie, with foal by Clydesdale horse Plucky Willie.

A good head. Clydesdale gelding, Prince, by Lord of the Isles; dam, Dolly.

Hawkesbury Agricultural College.

The Clydesdale Horse.

H. W. POTTS, Principal, Hawkesbury Agricultural College.

A LOCAL story is told in the neighbourhood of George Stephenson's birthplace on the Tyne to the effect that, when a young man, Stephenson was engaged in his momentous efforts to place a steam-engine on wheels, and use it as a locomotive. A well-known farmer in the district on hearing of this visited the obscure inventor, and threatened to throw him bodily into the river for daring to design a contrivance with the avowed intention of doing away with the necessity of growing horse-feed.

The railroad has revolutionised the trade of the world. Modern inventions have added to the facilities for mechanical locomotion with startling rapidity. Our country roads are invaded by motors. They claim an equal right to the thoroughfares with horses, and yet the demand for the latter is greater to-day, and the prices offered for sound draught stock are more attractive, than those realised at the inception of steam locomotion. No animal on the farm to-day earns a greater income for his owner than the draught-horse.

We are all familiar with the typical Clydesdale at our agricultural shows throughout the State and wherever farming is followed. In this climate the Clydesdale has assuredly maintained the high reputation he acquired in his native land. There he is noted for his power and hardiness in withstanding cold and wet; and here he has equally demonstrated his capacity for resisting dry conditions and continuous heat and sunshine.

Of late years the breed has steadily improved in several solid and enduring qualifications, notably towards a greater elevation of shoulder, roundness of barrel, levelness of top, with marked advance in style and action. The Clydesdale has for some years past earned a record for breeding true to type, and has proved constitutionally robust, virile, and vigorous.

He has achieved the most popular position amongst the draughts, owing to his usefulness for general agricultural purposes. His docility, gameness, and intelligence, as well as the symmetrical proportions of his compact, muscular body, smooth, clean, sound legs and feet, well-sprung ribs, sloping shoulders and pasterns, large joints, good quality bone, and attractive structural conformation, form an exceptional combination of activity and physical strength which claims for him the position of the farmer's most useful horse.

We all realise that a sire and mare should be competent to transmit defined qualifications to their progeny. Soundness and pedigree probably are the most important contributing factors towards this desirable end.

The Clydesdale Horse Society of Scotland, with its annual publication the *Stud Book,* has effected a slow but definite and permanent improvement

in the breed, and in no small measure assisted to provide the Clydesdale of to-day.

To the Society's efforts we may attribute the elimination of faults which were apparent in the early days of its work, such as the lengthy back, flat ribs, deficient bone, length of leg, lightness of body, weak loins, outward action in the hocks, swinging or twisting outwards of the fore-feet, drooping quarters, low-set tail, short, upright pasterns, and coarse, curly hair on the legs.

Added to this the shrewd, keen judgment and intuitive genius of the Scottish stud-masters, in commingling blood of leading strains, assisted in placing the Clydesdale in its enviable position to-day. The cross between Drew's "Prince of Wales" and the Darnley fillies left a race of draughts which really provide the model now designated the modern Clydesdale. In point of colour, the original breed was doubtless black. Fashion, however, changes, and the popular hues are brown, bay, and black, in their order of merit. Greys are tolerated in the show ring, roans are rarely seen, and chestnuts are not recognised.

In markings, the white blaze down the face, with white legs, are characteristic; but it should be mentioned that, whilst such features are often quoted as emblems of purity, it by no means debars others from obtaining leading positions in the show ring.

It may be here remarked that in some districts in this State the white hair of the legs is attacked by an aphis and stripped, hence much white is not looked upon with favour in such localities.

The head assists a judge in estimating character; and in the typical Clydesdale we look for moderate size, with broad and full forehead, tapering towards the setting on of the ears; a somewhat flat face, with an absence of the Roman contour or its converse; a full, placid, round eye, bright and lively, conveying an expression of kindliness, docility, intelligence, and muscular energy; a wide, rather square and coarse muzzle; large, roomy, open nostrils; lips thin and elastic; ears fairly large, long, carried smartly; the lower jaw deep and broad.

The head with fine, bold, commanding outlook should indicate endurance, courage, spirit, gameness, activity, and a tractable disposition. The most taking horses are worthless without an intelligent head and good eyesight. Clydesdale mares and sires are renowned for their well-formed, massive, muscular, and gracefully-crested necks, carrying an abundance of long soft mane. The shoulder is rather large, broad, flat, and sloping. In this regard it is considered that the oblique nature of the shoulder contributes towards the action and style of the foreleg.

The arm is short, the chief feature of this being to keep the leg straight and well under the chest and placing the elbow close into the body. The forearm is well muscled and the bone long; large flat knees, straight and deep, with sound flinty cannon bones, are important points, and these, with the feet and pasterns, combine to give the Clydesdale its great reputation

Countess, with foal by Lord of the Isles.

Blanche, with foal by Darnley Again.

Clydesdale Mares and Foals at Hawkesbury Agricultural College.

Prince, age 7 years, by Lord of the Isles; dam, Dolly, by King Tom.

Farmer, age 12 years, by Lord Lyon; dam, Brownie, by Muir Lad (imp.).

Clydesdale Geldings at Hawkesbury Agricultural College.

Bruce, age 9 years, by Lord of the Isles; dam, Dolly, by King Tom.

Briton, age 7 years, by Lord of the Isles; dam, Darling, by Lord Lyon.

Clydesdale Geldings at Hawkesbury Agricultural College.

Clydesdales at Hawkesbury Agricultural College.

1 and 3, double-furrow plough teams; 2, single-furrow plough team; 4 and 5, 5-furrow disc plough teams.

for sound legs and feet and active gait. The quality of bone and conformation ensure the animal's usefulness until an old age, with immunity from leg troubles. The bone below the knee must be broad and strong, tapering towards the back with well-grown and fine tendons.

Strength again is apparent in the fetlock. With the pastern we find the supplementary sloping lever in the oblique shoulder, in which the high clear rise of the foot is obtained with flexible knee action.

The pastern is one of the important features in the bone formation in the breed, in order to obtain that elasticity of movement and freedom from concussion for which the Clydesdale is renowned.

Scotchmen always claim that the Clydesdale has the soundest and best wearing foot amongst draughts. That quality is emphasised here in our warm climate, where all the natural conditions favour the growth of dense horn and healthy tissue.

The foot should be moderately deep, sloping outwards as it descends from the coronary bands; symmetrical, solid, and large, with the heel wide.

A capacious chest and broad, deep bosom characterise the best horses, in which the vital organs have ample room for healthy vigorous action. The spacious girth evidences strong constitution. It is from this centre the functions of the body are maintained, and, needless to say, a well-formed chest is appreciated by the judge.

The back should be short, straight, and broad; the bony structure well clothed and braced with muscles and ligaments; the ribs well sprung and the back ribs well let down, forming a short barrel and short coupling. The loin is wide and level, short and muscular, with round deep quarters, broad and strong. The second thighs, or gaskins, show great power and are long and wide. The hock attracts attention from owners, in so far that the main leverage is directed from this joint. The hocks in the Clydesdale must be closely carried together, with the points inclined inwards. It is held by most successful breeders that this formation is one of the mainstays in the reputation of the breed, and assures a lengthy period of practical utility. The mechanism of the hock is liable to interference from unsoundness, and it should, therefore, be clean, strong, and well-defined. The cannon bones, pasterns, and feet, as with the forelegs, should be free from blemish and full of strength and quality.

From the back of the legs a free fringe of soft, straight, silky hair, commonly called "feather," should grow down to the back of the fetlock and around the hoof. There is a tendency to less profuseness here, but in all cases where the hair is coarse, dense, curly, or woolly, the animal is rejected in good company. The front of the leg and round the fetlock joint must be clean and smooth. It is claimed that the presence of a fine fringe of feather indicates purity of type. Judges in this State are inclined to look with less favour on profuseness of fringe, relying more on quality.

What is justly claimed for the modern Clydesdale is the development of action, and in this regard the animal has secured well-merited approval from farmers. Both in the walk and trot there is a grace, boldness, and ease of movement, associated with a game bearing of the head which cannot fail to attract attention. As a walker the animal is deliberate and regular. With the aid of the knee and shoulder the sole is fully exposed and the foot sent forward in a long swinging stride and laid squarely. The step is firm, free, and springy. The hind leg is lifted smartly, and all the parts flexed with precision. The foot is passed sharply forward and brought to the ground firmly. As trotters they are fast and nimble.

We may regard the Clydesdale as essentially sound and, to a large extent, free from hereditary diseases. Fortunately, for the welfare of the breed and the interests of the farmer, veterinary inspection of stud horses is being introduced throughout Australia. The sire is remarkably prepotent and imprints his qualifications on grade stock with fidelity.

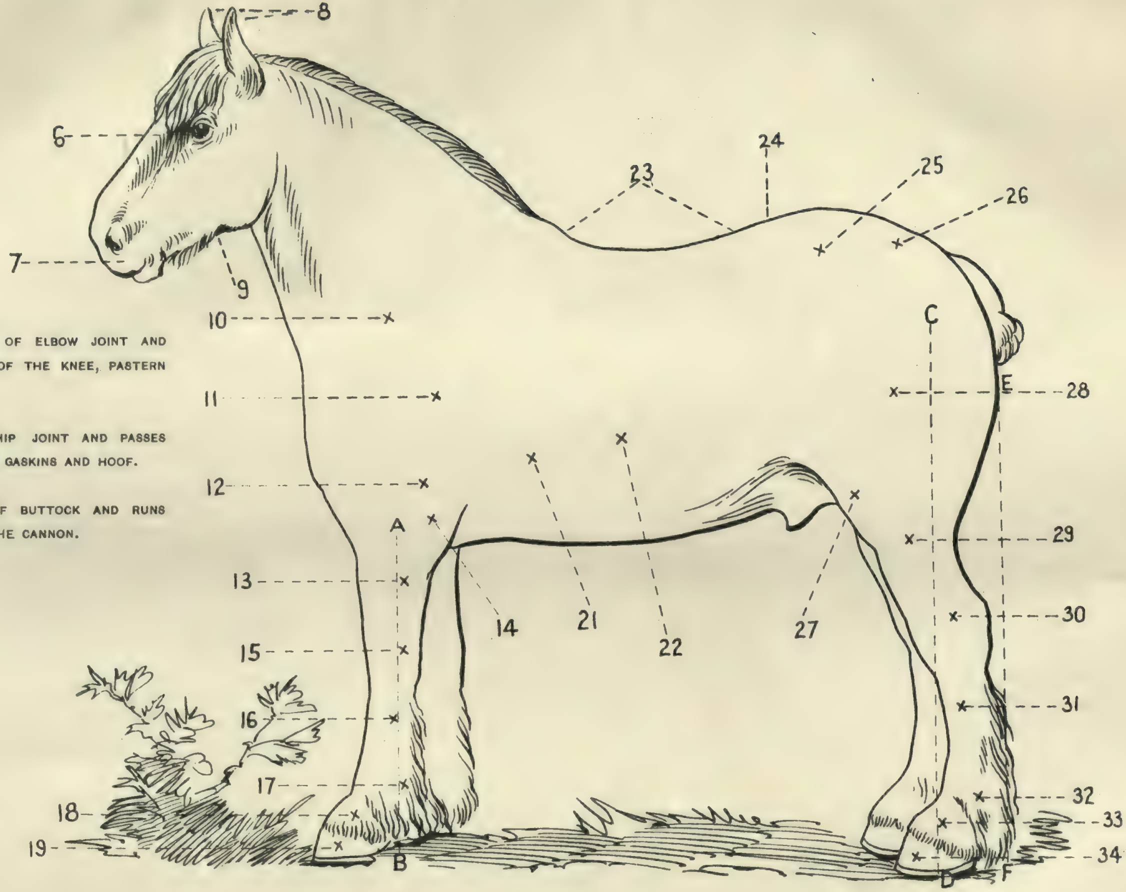
In the breeding of crosses considerable experience has been gained in this State in producing light, active, sturdy, farm-horses by mating the thoroughbred with the Clydesdale mare.

Hawkesbury Agricultural College and Experiment Farm, Richmond, New South Wales.

STUDENTS' SCORE CARDS.

DRAUGHT HORSES—CLYDESDALE STALLION.

Scale of Points.	Maximum Points.	Student's Estimate.	Instructor's Estimate.
General Appearance—16 Points, as under :—			
1. Weight (according to age)	4	......	......
2. Symmetry—Broad, clear outline ; massive and well-proportioned ; game and active, with smart, distinguished bearing.	4	......	......
3. Quality—fine, clean bone, ample substance ; silky feather, not profuse ; well-defined tendons and good skin.	4	......	......
4. Temperament—Alert, docile disposition, energetic and tractable.	4	......	......
Head and Neck—7 Points, as under :—			
5. Head—Moderate size, well carried, full broad forehead, tapering up towards the base of the ears, flat face.	1	......	......
6. Eye—Full, placid, round, bright, with an expression of kindliness and vigour.	1	......	......
7. Muzzle—Wide, rather square ; roomy, open nostrils ; neat, muscular, elastic lips.	1	......	......
8. Ears—Long, fairly large, set smartly	1	......	......
9. Lower Jaw—Deep, broad, angles wide, space between free and clean for windpipe.	1	......	......
10. Neck—Strong, muscular, medium length, showing more crest than other breeds ; large windpipe and fine throat latch.	2	......	......



LINE A B DROPS FROM CENTRE OF ELBOW JOINT AND FALLS OPPOSITE THE MIDDLE OF THE KNEE, PASTERN JOINT, AND BACK OF HOOF.

LINE C D DROPS FROM THE HIP JOINT AND PASSES THROUGH THE CENTRE OF THE GASKINS AND HOOF.

LINE E F DROPS FROM POINT OF BUTTOCK AND RUNS PARALLEL WITH THE LINE OF THE CANNON.

THE ABOVE PLATE REPRESENTS A CLYDESDALE STALLION, THE NUMBERS REFERRING TO THE SCORE-CARD ON PAGES 1132-1134.

Scale of Points.	Maximum Points.	Student's Estimate.	Instructor's Estimate.
Forequarters—22 Points, as under :—			
11. Shoulders—Strong, muscular, moderately sloped, with broad bearing surface, and close topped.	2	......	......
12. Arm—Strongly muscled, short, thrown forward, keeping the foreleg straight and well under the chest.	1	......	......
13. Forearm—Muscular, broad, and long	2	......	......
14. Elbow—Strong, clean, and set close into the body ...	1	......	......
15. Knees—Large, flat, straight, and deep	2	......	......
16. Cannons—Strong, dense, flinty bone, viewed from front or side tapering towards the back of the leg ; tendons hard, thick, clean, and distinct.	2	......	......
17. Fetlocks—Large, wide and strong	1	......	......
18. Pasterns—Long, sloping, and strong	3	......	......
19. Feet—Symmetrical, solid, large, round, squarely placed ; heels wide and clearly defined ; horn dense, soles concave, bars strong and large, frogs elastic ; coronets wide and round in proportion to the legs ; the hoofs should spread as they descend from the coronet.	5	......	......
20. Legs—Normally placed and straight, neither inclining inwards or outwards at the knee. To test this from a front view, suspend a plumb-line from the point of the shoulder ; it should fall opposite the centre of the knee, cannon, pastern, and hoof. At the side, a plumb-line dropping from the centre of the elbow joint should fall opposite the middle of the knee, pastern joint, and back of hoof. There should be a fine growth of soft, silky, straight hair, forming a fringe from the back of the knee down the leg to the pastern joint. The front of the leg and fetlock joint must be clean and smooth.	3	......	.. ...
Body—8 points as under :—			
21. Chest—Well-developed, wide, low, capacious and deep, with a large girth, high withers and full bosom.	2	......	......
22. Ribs— Fore-ribs well sprung and deep, giving ample room for heart and lung action, ; back-ribs deep, round, and well let down, forming a round barrel and short coupling.	2	......	......
23. Back—Short, level, broad and muscular...	2	......	......
24. Loin—Wide level, short and muscular	2	......	......
Hind-quarters—33 points, as under :—			
25. Hips—The bones well apart, symmetrical and smooth...	2	......	......
26. Croup—Level, muscles strongly developed, tail well set on, and carried freely.	2	......	......
27. Stifles—Strong, muscular, and well apart	2	......	.. ...
28. Quarters—Well-turned, broad, deep, heavily muscled, and low set.	2	......	......
29. Gaskins or lower thighs—Prominent, long, wide and muscular.	2	......	......
30. Hocks—Points well defined and clean cut, strong not fleshy, muscular and straight.	8	......	......
31. Cannon bones—Broad near the hock, and tapering towards the back, stout, clean, with large tendons, clearly defined and set well back.	2	......	......
32. Fetlocks—Strong, wide, clean	1	.....	......
33. Pasterns—Oblique, long and strong	2	......	......
34. Feet—Moderately deep, large, even size, dense horn, concave sole, large elastic frog ; heel wide, high, one half the length of toe ; hoof to spread evenly downwards from the coronet.	6	......	......
35. Legs—A plumb-line suspended from the hip joint at the side should pass the centre of the gaskins and hoof. Again, a plumb-line hung from the point of the buttock should run parallel with the line of the cannon. The points of the hock must be carried closely together, somewhat inclined inwards. A soft, straight, silky fringe of feather should extend along the back of the cannon to the pastern.	4	......	......

Scale of Points.	Maximum Points.	Student's Estimate.	Instructor's Estimate,
Action—14 points.			
36. Walk—Light, springy, smooth, quick, long stride and balanced well, step firm and brisk, feet lifted well, showing the full sole, and placed squarely on the ground. Smart, even shoulder and knee action. The hind leg is lifted smartly, sent far and sharply forward, and brought firmly and squarely to the ground. The heels to be slightly inclined inwards and toes outwards.	8		
37. Trot—Rapid, free, nimble, even and regular, with a gay, smart bearing.	6		
Total	100	.. ...	......

Name or number of animal...... . ... Markings ....
Age .... Colour.. ....
Height .... Weight ....
Name of student ....

Date ....

Electro-magnetic Fishing for Broken Bore Tools.

R. S. SYMMONDS.

The Great Australian Artesian Basin, with a known area of 364,000,000 acres, has a peculiar fascination for the man of science. The successful utilisation of artesian water for agricultural purposes is a problem which presents many difficulties, foremost among which may be mentioned one of the well-borers' difficulties—that of fishing for lost tools.

M. Mulot, an experienced geologist, when sinking the Grenelle bore, in France, gained some experience of this difficulty. In 1833 the necessary works were commenced with boring-rods about 27 feet long, attached to each other, and which could be raised or lowered by mechanical means; and an ingenious method was adopted for giving them a circular motion.

The diameter of the bore-hole was about 6 inches. The instrument attached to the end of the lowest boring-rod was changed according to the different strata which was successively reached, the form adapted for passing through the softer materials of the surface being unsuitable to boring through the chalk and flint—a hollow tube being used for the former, while the latter was penetrated by a chisel-shaped instrument. The size of the rods diminished in proportion to the depth, and as the subterranean water was not reached so soon as was expected, it became necessary several times to enlarge the diameter of the bore, to admit of the work being successfully

Gelding, Trooper, age 18 years; sire, Clydesdale Prince Colm; dam, a thoroughbred mare by Tim Whiffler.

Still in full work daily in College drag and sociable.

Gelding, Junket, age 19 years; sire, a thoroughbred horse; dam, a Clydesdale mare.

Still in regular work on the College farm and orchard.

Hawkesbury Agricultural College.

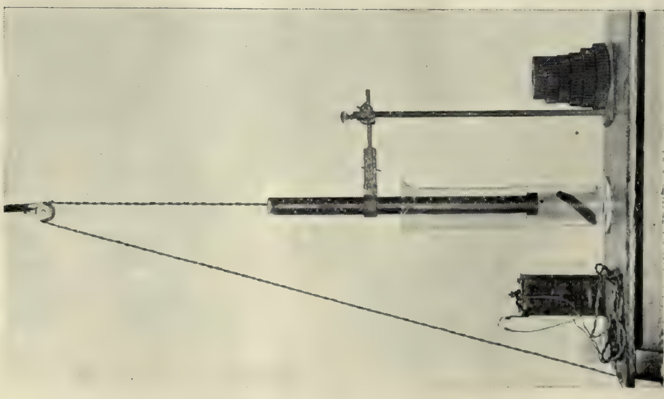


Fig. 1.

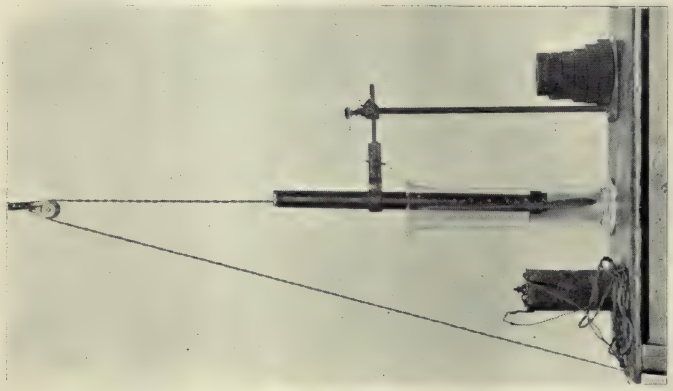


Fig. 2.

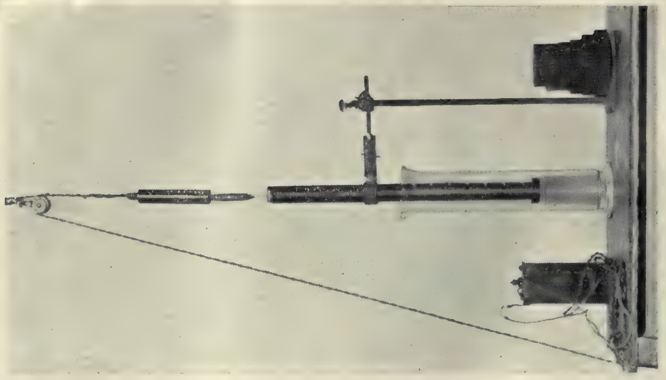


Fig. 3

Electro-magnet Fishing for broken Bore Tools.

continued. Accidents occurred also, which tried the utmost patience of the projectors. In May, 1837, when the boring had extended to a depth of 1,254 feet, a hollow tube, with about 270 feet of the boring-rods attached to it, broke, and fell to the bottom of the hole, and it was necessary to extract the broken parts before any further progress could be made. The difficulty of accomplishing this may be conceived when it is stated that the different fragments were not withdrawn until after the lapse of 15 months. Again, in April, 1840, in passing through the chalk, the chisel attached to the boring-rods became detached, and before it could be recovered several months were spent in excavating round it. A similar occurrence created an obstacle which impeded the work for three months, but instead of being withdrawn, the detached part was driven laterally into the stratum, which happened to be gravel. At length, in February, 1841, after eight years' labour, the rods suddenly descended several yards; they had pierced the vault of the subterranean waters of which M. Mulot had been so long in search.

The Australian well-borer of the present day has an intimate knowledge of the difficulties met with when "fishing" in a 6-inch hole for lost tools, and many ingenious devices have been invented to induce the missing tool to "bite." Notwithstanding these inventions, many months of valuable time are frequently spent, considerable patience displayed, and no small amount of expense incurred, in picking up lost tools. The unique properties possessed by the electro-magnet have not, so far as I can glean, been utilised in accomplishing this tedious task. The idea was suggested to Mr. J. S. Fitzmaurice, M.I.E.E., M. Amer. I.E.E., who promptly produced and photographed the following interesting model, which works in a very satisfactory manner. To those interested this appears to be an important matter, and the suggestion is worthy of being tested on a larger scale.

The apparatus shown in illustrations Figs. 1, 2 and 3, is very simple, and is intended to represent an artesian bore with a lost tool at the bottom. The glass cylinder represents the bore, and contains water charged with alkaline carbonates.

The steel tube supported by the clamp is $1\frac{1}{8}$ inch internal diameter by 14 inches long, and is intended to represent the steel or iron bore-casing. The single dry cell represents source of electrical supply.

Fig. 1 depicts the lost tool lying at an angle at the bottom of the bore.

Fig. 2 shows the tool lifted from the bottom of bore by the electro-magnet.

Fig. 3 shows the electro-magnet with tool attached after passing up the bore-casing.

The electro-magnet, which is of the ironclad type, is very powerful, and is made waterproof to resist the effects of water. Its dimensions are as under :—

External diameter	$1\frac{1}{16}$ inch.
Length over all	5 inches.
Weight	15 ounces.
Conductor resistance	1·57 ohms.
Current absorbed	·5 ampere.

Orchard Notes.

W. J. ALLEN.

December.

Pests.

KEEP a strict look-out for pests, and if trees have not been fumigated or sprayed, as the case may be, the grower should lose no time before beginning to fight them. For scales on citrus trees, December, January, February, and March are good months for either spraying or fumigating; but for fungus diseases it is generally best to spray once before the tree blooms and again as soon as the fruit has set, rather than leaving it until now. In many cases, however, later sprayings are both beneficial and necessary. The grower should not neglect to either fumigate or spray all citrus trees so as to ensure clean fruit and healthy trees, but do not treat trees that are weak and out of condition, else they may be damaged.

Complaints have been made by a few orchardists of the burning of the foliage with arsenate of lead. As there are several brands on the market it would be well for orchardists to apply the spray to a section of a tree of the different varieties in the orchard, as by making such tests one is enabled to ascertain if the mixture is too strong, and if so, the quantity of arsenate of lead may be reduced, so that no scorching or damage to either leaves or fruit will occur. Some varieties are more tender than others, and by carrying out experiments as described above the grower will know how to reduce the strength of the arsenate of lead when spraying such varieties. The first spraying to be given, just as the petals are falling, should be the strongest application, while for subsequent sprayings the quantity of arsenate of lead may be reduced to 1½ lb. to 50 gallons of water, and it may be found that for some brands of arsenate of lead 2 lb. to 50 gallons of water will be quite strong enough for the first application.

By testing the spray on a few trees before proceeding to treat the orchard the possibility of damaging foliage or fruit may be avoided.

Codling Moth.

Keep a strict watch over bandages on the apple, pear, and quince trees, and see that all fruit is picked up and destroyed, either by feeding it to stock immediately or boiling or burning it, but not by burying it, as a few of our careless growers have tried to do. It is to the interest of every grower to see that every grub is destroyed before it can fly. The man who buries his fruit is only breeding moths for himself and his neighbours, and, therefore, in the interests of the fruit industry, it is hoped that any growers who may be found resorting to this means of disposing of their fruit will be reported to the Inspectors and made an example of. We hope that growers will assist the Inspectors in every way possible, and where they know of those who are trying to evade the Act they will report them.

Fruit Fly.

As soon as this pest makes its appearance set kerosene traps around the trees or hang them in the trees. These traps are tins about 5 or 6 inches square and 2 inches deep, with a half-inch of kerosene on the bottom. Pick up and boil or burn all fallen and infested fruit every day.

Pumpkin Beetle.

The Orchardist at Hawkesbury Agricultural College reports as follows :—To every pound of slaked lime add one-quarter ounce of Paris green. The handiest way to apply it is to make a bag of double cheese-cloth, put the mixture in the bag and shake gently over the plants. One man can go over several acres in a day. I find it much more convenient than spraying. The operation must be repeated every time wind blows the lime off or it is washed off by rain. Apply early in the morning, as it sticks better when the plants are damp. Some growers have given occasional sprayings with Swift's arsenate of lead, which they claim has given good results.

Spraying Tests for San José Scale.

The special resin wash at full strength did no injury to foliage, but loosened many of the peaches. With 25 per cent. more water added the results were the same.

For Peach Aphis.

In connection with experiments carried out at Hawkesbury College orchard, the Orchardist further reports :—

"Sprayed peach-tree with scalecide at the rate of 1 to 80 gallons of water ; burnt foliage, loosened most of the fruit. The aphis as thick as before the tree was sprayed.

"One tree sprayed with Cooper and Nephew's V. 1 Fluid ; no injury to foliage ; a few fruit loosened. Did not destroy all the aphis.

"Used sawdust and snuffotine (three dressings). Results not satisfactory.

"Nikoteen (Morrison's), at the rate of 1 pint to 80 gallons of water, gave the best results."

Exporting Apples.

It is time to make arrangements for space in boats if fruit is to be sent to Europe this coming fall. It would be well for those who have a good crop to arrange to send a trial shipment, be it ever so small, either in conjunction with some person or company who is exporting, or, better still, through the medium of the Fruit-growers' Union.

Irrigation.

Where irrigation is practised it will be found necessary in most cases to give the soil a good soaking this month. Where young trees or vines are being watered, see that the soil is well soaked around their roots, and as soon as the ground is dry enough after the watering, cultivate the land thoroughly, and work around the trees and vines with a fork hoe.

Fruit-curing.

Apricots will be the principal fruit for curing this month. See that the fruit is perfectly ripe before picking ; then cut them evenly, fumigate, and

put them out in the sun with as little delay as possible. Do not cure them too much, but take them in whilst yet quite pliable—after most of the moisture has left them. Pamphlets on curing fruit may be had on application to the Department of Agriculture. These will give all details in connection with this important work. (Fruit-drying, Miscellaneous Publication No. 919; Canning and Bottling, No. 999.)

Cultivation.

All orchard land should be kept free from weeds, and to this end the horses and cultivators should have but little rest this month, as an orchard neglected for a few days will soon be covered with a coating of summer grass which will take many a hard day's work to eradicate, and couch grass spreads rapidly when left undisturbed. Where there are bad patches of couch grass, they should be ploughed up and harrowed on a very hot day, as the roots soon die when exposed to the sun.

Passion Vines

which have been properly pruned and manured during November, will now be putting on good growth and blooming freely. This fruit will be ready to meet the demand at Easter, when it usually finds a ready sale at good prices.

Pineapples.

In tropical districts pineapples may be planted if moist weather prevails. Suckers are the best to plant, being much the strongest and earliest to arrive at maturity. Being great feeders, a dressing of strong nitrogenous fertiliser will promote rapid growth and fine fruit. While the plants are young cultivation must be thorough but not deep enough to cut the feeding roots, which are near the surface.

Bananas and other tropical fruit may be planted during the rainy season.

Thinning Fruit.

In nearly every orchard are found trees which are apt to overbear, or which carry heavy crops every alternate year, while during the off year they set very little fruit. During the plentiful year the tree is so weakened that it requires a year's rest before it is in condition for carrying a crop. How much better would it be therefore if we would use every means to regulate the cropping. That is, to try and help the tree carry yearly crops of good fruit, in place of heavy crops of indifferent fruit every other year and very little during the off year.

In order to obtain the fruit which is most sought after by exporters as well as for the local trade, we must have medium to large fruit, of good colour and flavour, and this we seldom get from a tree which is allowed to overbear, so that it is best to resort to heavy pruning during the winter previous to the summer when a heavy crop is anticipated. If it is found that the tree still sets more fruit than it can properly mature it is best to remove a fair proportion from the tree. In some cases as much as half of the fruit requires to be taken off. This thinning should take place as soon as possible after the pits harden in stone fruits, while apples may be thinned towards the latter part of November in the cooler districts, and a little earlier in the warmer districts. Picking off and destroying moth-infested apples and pears should always be practised.

Loquats require thinning soon after they are well set if the largest fruit is to be expected.

New South Wales Strong White.

GEO. L. SUTTON, Wheat Experimentalist.

In view of the fact that a considerable proportion of the wheat now grown in New South Wales is of varieties bred specially for their good milling properties—a fact which a number of local buyers recognise by offering for such wheats prices well above those paid for standard white varieties—the time seems opportune to adopt for these improved wheats a distinct class, with appropriate trade designation. As will be seen in the following table a number of the Departmental crossbred wheats, of which Comeback may be taken as a typical representative, compare in milling qualities favourably with Manitoba Fife, which is recognised as the standard of the world for strength.

Milling Results of Manitoba and N.S.W. Wheats (by F. B. Guthrie).

Variety.	Weight per bushel.	Per cent. Flour.	Per cent. Pollard.	Per cent. Bran.	Nature of Flour.		
					Colour.	Strength	Per cent. Dry Gluten.
Manitoba—							
No. 1 Hard Red (imported grain)	63¾	70	14·7	15·3	Excellent	51·2	12·37
Power's Fife. Grown in N.S.W.; one of the best of the Manitoba varieties	63	72	14·0	14·0	V. good.	56	13·0
N.S.W. Strong White—							
Comeback	63¼	72	14·5	13·5	V. good.	55	18·3
Jonathan	63	71	14·0	15·0	Excellent	56	13·0
Bobs	63	70	15·5	14·5	Excellent	54	11·0

The wheats commonly grown in New South Wales prior to evolution of the Departmental crossbreds enjoyed a reputation for producing a large percentage of flour of unexcelled whiteness, but were rather deficient as regards strength. The new type of wheats of which it is proposed to form a distinct class, in addition to producing a large percentage of flour of excellent colour, also produces a flour that is strong. Hitherto the F.A.Q. (fair average quality—arrived at by admixture of all varieties and types of wheat produced in the State) has been the only standard of quality recognised by the trade, but it is now evident that the recognition of another standard or class is necessary in the interests of the millers and farmers.

After some correspondence and consultation with Mr. C. Binnie, of Baan Baa, who has always taken a very prominent interest in all matters connected

with the cultivation of Farrer's strong wheats, it is suggested that a suitable term for this class is

New South Wales Strong White.

Such a designation seems apt, in that it indicates that the wheat so described is produced in New South Wales, and that its character is such that on being milled it yields a flour that is *strong* as well as *white.*

Samples of such a class will be recognised by the *white horny* appearance of the grain cut across as distinguished from the *white floury* appearance of the old class.

The recognition by the grain trade of such a term will convey, as nothing else will, to the buyers in oversea markets that in the future they may look to New South Wales for their supply of "strong" as well as "white" wheat and flour. This is to the advantage of all interested in the wheat industry, and will help to dispel the prevailing impression that the climate of Australia is unsuitable for the production of "strong" wheats.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1909.

Society.	Secretary	Date.
Berry Agricultural Association...	C. W. Osborne	Dec. 8, 9, 10

1910.

Albion Park A. and H. Society...	Hector G. Fraser	Jan. 19, 20
Kiama A. Association	R. Somerville	,, 26, 27
Wollongong A., H., and I. Association	F. W. Phillpotts	Feb. 3, 4, 5
Shoalhaven A. and H. Association, Nowra	Henry C. Rauch...	,, 9, 10
Coramba District P., A., and H. Society	H. E. Hindmarsh	,, 16, 17
Alstonville A. Society	W. Monaghan	,, 16, 17, 18
Nambucca (Macksville) A. and H. Association	R. Turnbull	,, 16, 17, 18
Kangaroo Valley A. and H. Association	E. G. Williams	,, 17, 18
Queanbeyan P. and A. Association	E. C. Hincksman	,, 17, 18
Guyra P., A., and H. Association	P. N. Stevenson	,, 22, 23
Manning River A. and H. Association...	S. Whitbread	,, 23, 24
Tumut A. and P. Society	E. H. Vyner	,, 23, 24
Ulladulla A. Association...	J. Boag	,, 23, 24
Bellinger River A. Association ...	S. S. Hindmarsh	,, 23, 24, 25
Gunning P., A., and I. Society...	W. T. Plumb	,, 24, 25
Robertson A. and H. Society	R. G. Ferguson	,, 24, 25
Wyong Agricultural Association	Edgar J. Johns	,, 25, 26

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